



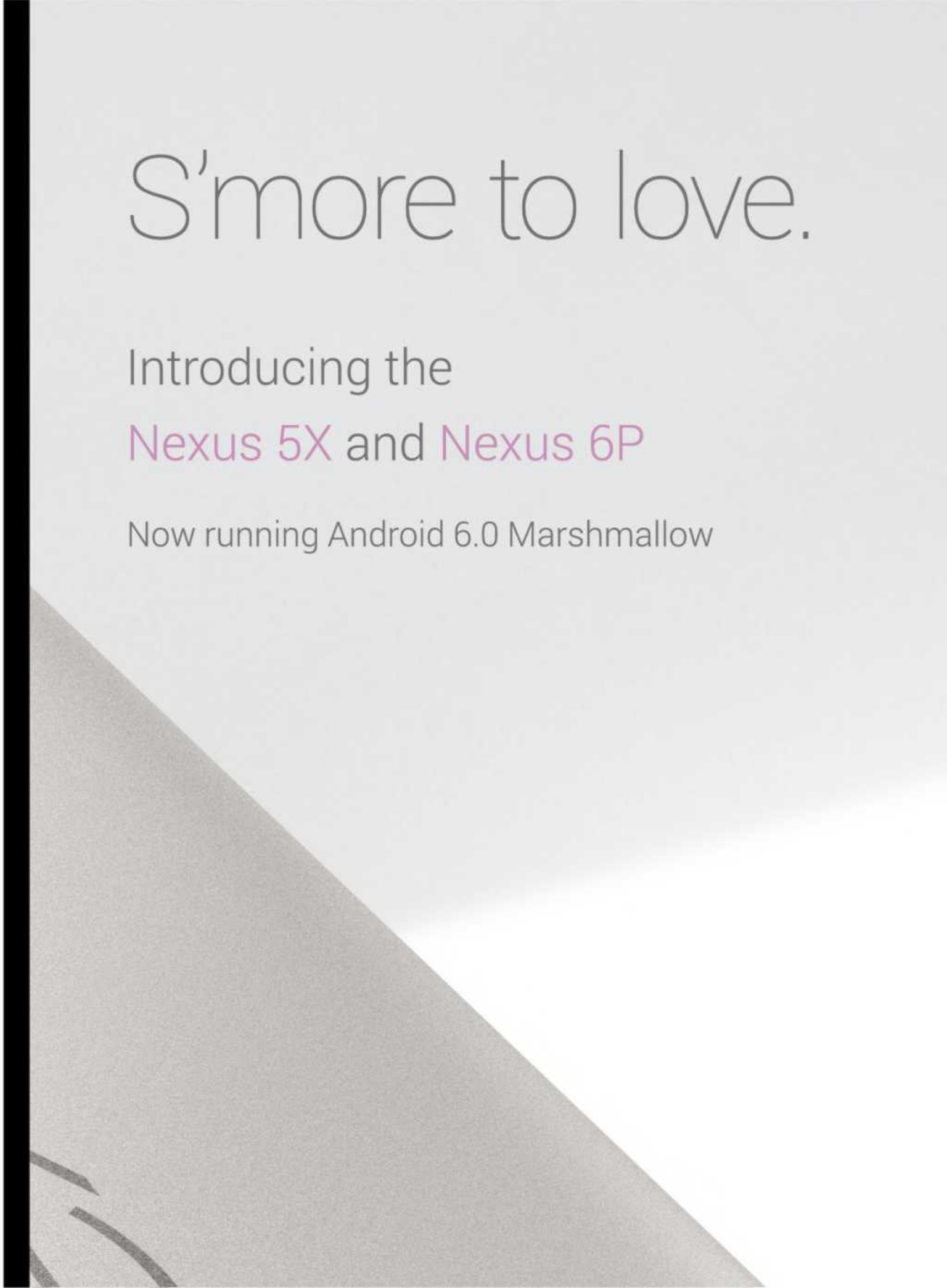

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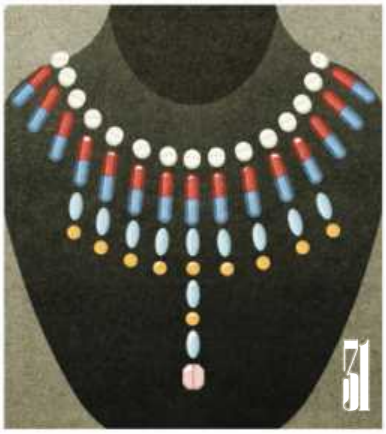
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Make awesome cocktails this holiday season, with science! WIRED articles editor Adam Rogers, author of *Proof: The Science of Booze*, joins some of the Bay Area's smartest bartenders as they harness the power of chemistry to make tasty, pro-quality drinks at home.

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FROM ONE FAN TO ANOTHER

"What is the friggin' deal with those Jawas?" I remember thinking to myself. I was scared, and who could blame me? Those chattering little bastards were menacing: a skosh taller than me, beady yellow eyes glowing like cinders under their dark burlap hoods. They surrounded a slightly paunchy Darth Vader, one Jawa clinging to his leg, which was odd in retrospect, because even though Vader grew up on Tatooine, there is no cinematic evidence of his ever hanging out with Jawas. But there they were, a few story-line-challenged cosplayers standing in line at a West Texas strip mall in the summer of 1980—terrorizing the likes of 4-year-old me. My dad hadn't planned for me to be terrified when he brought me to see *The Empire Strikes Back*, of course. He just wanted me to learn to love *Star Wars*. ¶ Four decades later, we can debate whether George Lucas really understood how deeply the world he invented would affect our culture, but even as a scared kid, I knew *Star Wars* was for me. The films have been a constant in my life—an emotional refuge. They've given me goose bumps, made me angry, given me hope. Being a fan means you own those feelings, and that you care. A lot. ¶ I haven't seen the new movie (though I have put the three trailers on autoplay-repeat for extended periods). And I admit, when I heard about it, I was nervous. I can still taste the prequels. But J.J. Abrams is a fan too. He cares a lot too. The man has a plexiglass-encased, life-size bust of Grand Moff Tarkin at the reception desk of his production company, for God's sake. When I went to Santa Monica to interview him, I was reminded, yet again, that a filmmaker who loves *Star Wars* as fiercely as any fan is in charge of reanimating it.

I suspect that we're about to experience a planet-wide resurgence of *Star Wars* enthusiasm. Somewhere out there, a 4-year-old kid is about to have his life changed forever. And somewhere (OK, in my office), a 39-year-old is about to reconnect to some pretty intense stuff. To paraphrase some of my favorite people: I have a very good feeling about this.



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WHEN WE THINK of innovative design, often it's discrete objects—a gorgeous tea kettle, a sleek Bluetooth speaker, the original iPod—that come to mind. But for this year's design issue, we wanted to go big. Our subject: cities. From the gondolas soaring above the streets of Medellín, Colombia, to the museum that spirals into the earth in Shanghai, these ingenious efforts are lighting the way toward a better, smarter future. (That's literally true in Los Angeles, which is retrofitting 4,500 miles of streets with smart LEDs.) Our list included cities as far-flung as Nairobi, Eindhoven, and Dubai because, as we've learned: Inspiration lives everywhere.

Re: "Cities by Design"

"I READ 23.10 FROM FRONT TO BACK. BOTH CONTENT AND DESIGN WERE OUTSTANDING."

Leon Taylor via email

"Not many people notice the great aspects of cities that make them unique, and some of those features are ahead of our time."
gumshel on WIRED.com

"When I look at cities like these, I know that we live in the future."
Maciej Maj (*@maj_maciek*) on Twitter

Re: "Cities by Design"

"Not good timing re: Mecca, given that the 2,000-plus people killed in a recent stampede appear to have been on the newly designed Jamarat Bridge. While the article does say the bridge still gets crammed with people, apparently the 'handful of exit ramps [that] can now help quickly clear the structure' didn't work as designed."
AgFox on WIRED.com

Articles editor Adam Rogers responds: The tragic stampede in Mecca during the hajj didn't happen on the Jamarat Bridge but in the tent city of Mina, which we also talked about in the story. Those pages were already printed when this happened; we modified the article online to acknowledge the events.



Re: Elite fliers get special treatment at LAX

"To me this portends a future where the rich will buy more isolation from 'normal people'—in gated communities, private schools, etc. As a result, they'll have less incentive to worry about problems that affect everyone."
Mel Tremper, Berwyn Heights, Maryland

A better network as explained by a city.

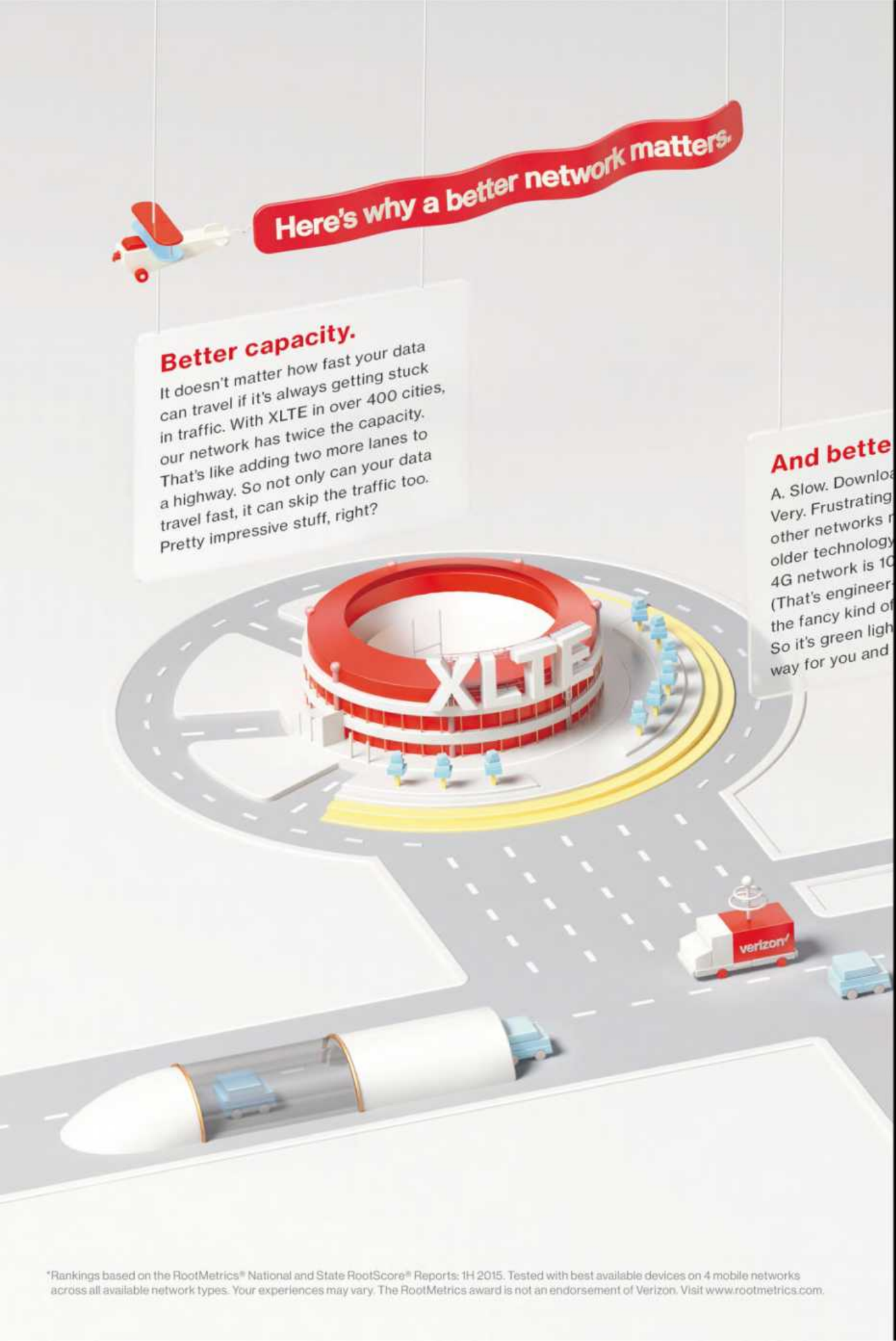
Here's why a better network matters.

Better capacity.

It doesn't matter how fast your data can travel if it's always getting stuck in traffic. With XLTE in over 400 cities, our network has twice the capacity. That's like adding two more lanes to a highway. So not only can your data travel fast, it can skip the traffic too. Pretty impressive stuff, right?

And bette

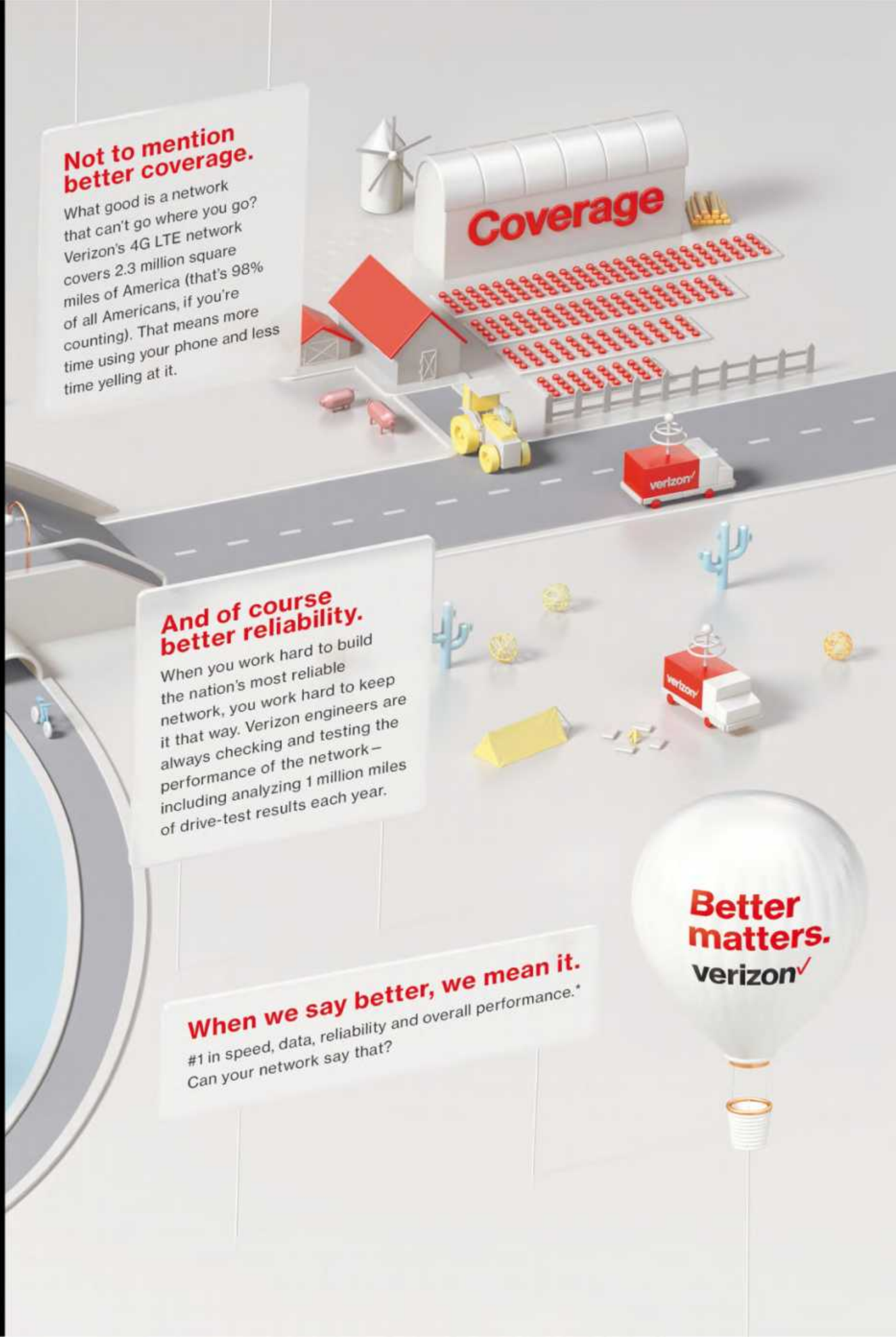
A. Slow. Downloa
Very. Frustrating
other networks
older technology
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*Rankings based on the RootMetrics® National and State RootScore® Reports: 1H 2015. Tested with best available devices on 4 mobile networks across all available network types. Your experiences may vary. The RootMetrics award is not an endorsement of Verizon. Visit www.rootmetrics.com.


r speed.
ad. Can. Be.
Unlike some
made with
, Verizon's
0% LTE.
-speak for
network.)
ts all the
your data.
SPEED
Gas
★★★★


Oh, and better backup.
When it comes to your wireless network, you just want it to work. That's why Verizon is always a step ahead with things like backup generators for most of our towers – making sure your phone works when you need it to.
Relia bility


Not to mention better coverage.
What good is a network that can't go where you go? Verizon's 4G LTE network covers 2.3 million square miles of America (that's 98% of all Americans, if you're counting). That means more time using your phone and less time yelling at it.
Coverage
verizon
And of course better reliability.
When you work hard to build the nation's most reliable network, you work hard to keep it that way. Verizon engineers are always checking and testing the performance of the network—including analyzing 1 million miles of drive-test results each year.
verizon
When we say better, we mean it.
#1 in speed, data, reliability and overall performance.*
Can your network say that?
Better matters.
verizon

Better matters.

verizon✓

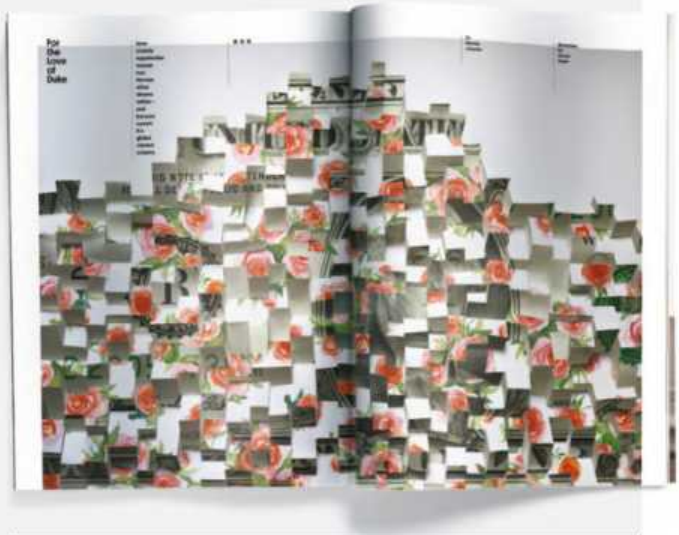
Join the better
network at vzw.com

Re: "For the Love of Duke": A woman falls for a romance scam

"I work in antifraud and sadly see these types of cases all the time. Some people you can't help because they don't want to be helped. I've shown people an alleged 'legitimate' email they've received listed as a scam on official websites, and they still don't believe it's fraud."
WhatsAUsername on WIRED.com

"I found this fascinating. It's unbelievable that there are people who fall for things like this, but I guess it just shows how desperate people are for affection from somebody else. Really sad."
hammerhead993 on WIRED.com

"It feels wrong somehow that the entire burden of restitution is on Audrey Elaine Elrod."
frosty dufour on WIRED.com



Re: "Say What?": the evolution of the voice interface

"HOW WILL DIGITAL ASSISTANTS COPE WITH THE HUMAN NEED FOR FLATTERY?"

Steve SanFrancisco on WIRED.com

Re: "Death, Actually": You can only die once in the videogame *Upsilon Circuit*

"Not for me, I wouldn't last 2 seconds."
@eve123456 on Twitter

"I find this a little bit freaky, disconcerting even."
@jacobs_ladder71 on Twitter

Re: "A Good Long Spell": Stop rushing fantasy authors

"My new policy is that I don't start reading anything until it's complete. If you tell me yours is the first of 10 novels, I'll check back after number 10 and see how the reviews are. I prefer stand-alones and series that aren't numbered."
swift_4 on WIRED.com



Re: "Mars or Bust": a guide to the Red Planet

"Is our vision of the future of the human race to go live in caves on another planet, on the edge of life and death? Besides the bragging rights of being first to go there, it sounds like a miserable existence with no real future."
pto on WIRED.com

"The timeline failed to include the historic first successful landings on the Red Planet of the Viking 1 and 2 spacecraft in 1976. This omission was no doubt caused by the failure to properly cut and paste the painstaking Wikipedia research."
divineshadow@myfairpoint.net

The editors respond: Good catch. It was a cut-and-paste error—from story to layout, not from Wikipedia. Our reporters aren't allowed to use Wikipedia as a source.



Re: "One More Thing": Q&A with *Steve Jobs* screenwriter Aaron Sorkin

"Sorkin says in the interview, 'I have no idea what I'm going to do. I don't know how to do this.' That's what I am saying every day of my life."
G. Sarigiannidis (*@ge_sar*) on Twitter

"Official title of the new Steve Jobs movie: *Aaron Sorkin's Danny Boyle's Michael Fassbender's Steve Jobs*."
Kawika Holbrook (*@kawika*) on Twitter



THEY MAY BE CALLED SMALL BUSINESSES, BUT THEIR IMPACT IS HUGE.

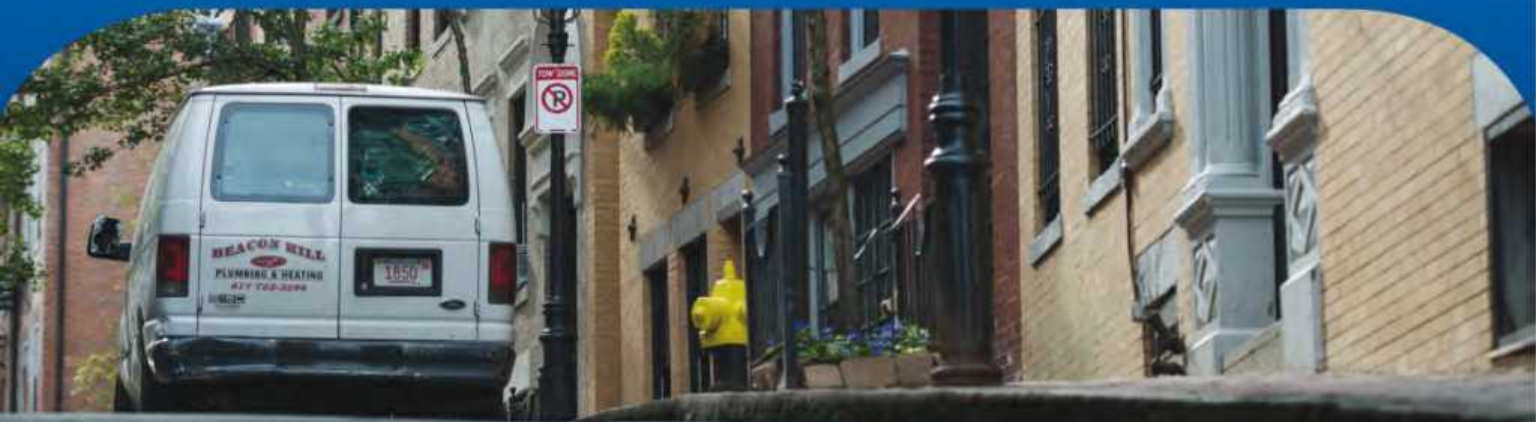
In the United States, over 50% of the working population is employed by small businesses. How can we make sure these companies grow and thrive?

Fleetmatics' mobile workforce solutions are making small vehicle-dependent businesses more competitive and efficient. But to help entrepreneurs everywhere, Fleetmatics needed a global bank. Working with Citi was critical to their growth. Now, they are not only helping improve productivity and create jobs in the U.S., but throughout the world.

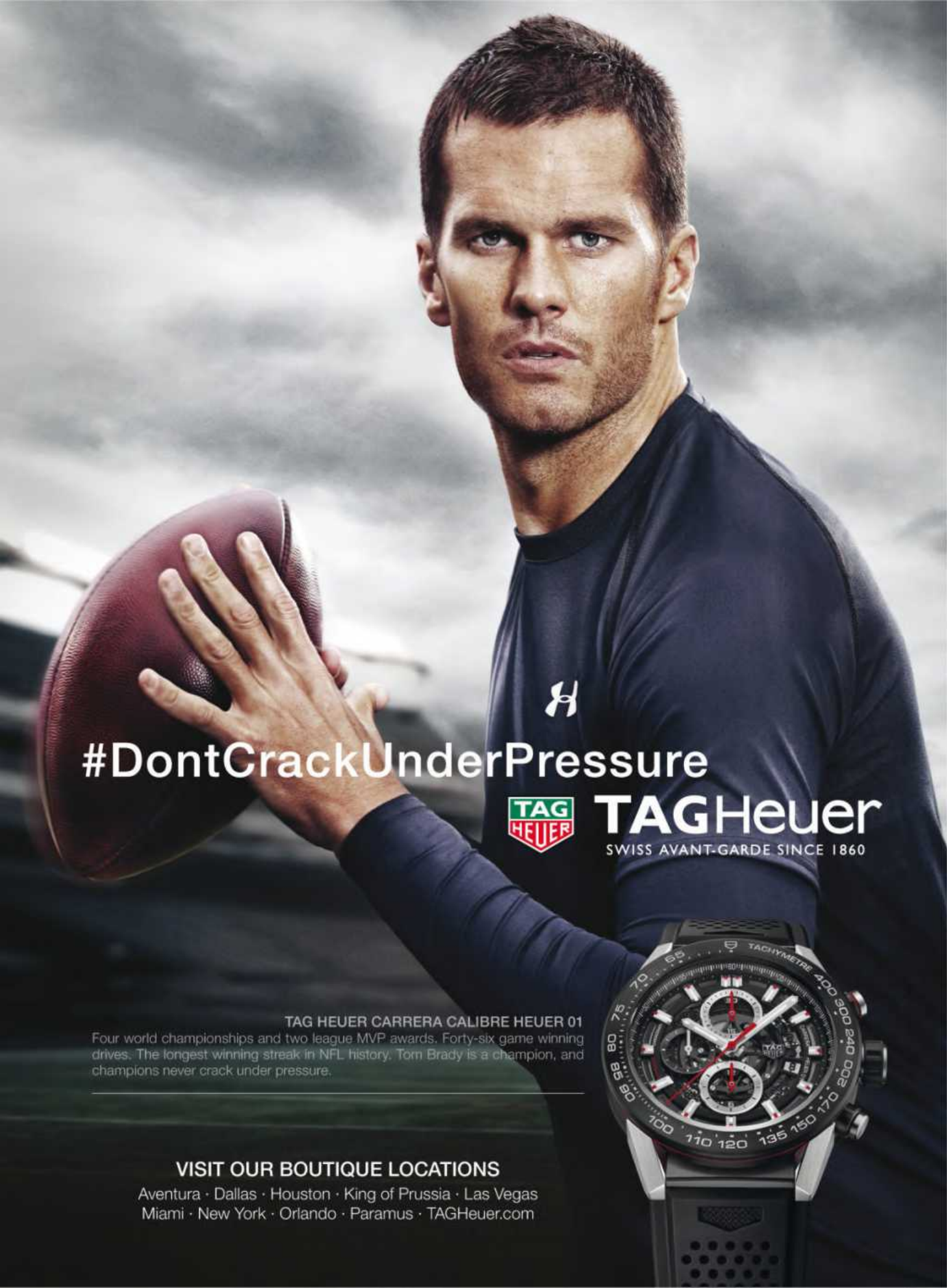
For over 200 years, Citi's job has been to believe in people and help make their ideas a reality.

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ARGUMENT

OUTRAGEOUS FORTUNE

HOW TO FIX PHARMA'S PRICE PROBLEM

BY DAVID WOLMAN



IN 1990, scientists in Italy published a study comparing the efficacy of two heart medications. After looking at more than 12,400 cases, they concluded that the newer and more expensive drug provided no significant improvement in health outcomes. The study was controversial and, not surprisingly, contested by Genentech, the company behind the costlier option. It also kickstarted a conversation about the rising cost of medicines. The price tag of the new drug in the study was $2,200 per dose, after all. ¶ How quaint. Today, many drugs cost more than $30,000 a pop. In the past 50 years, prices for cancer

drugs have increased a hundredfold, and spending on specialty drugs is forecast to double yet again by 2020.

The industry's riposte to any criticism about pricing is predictable: Regulations are complicated, biology more so, and R&D is expensive. Prices have to cover the costs. Get over it, or go find a naturopath.

That is only partly bullshit. Dealing with the chemistry of tomorrow and the regulatory hurdles of today *is* expensive. Yet in some European countries, the same name-brand prescription meds cost about half what they do in the US, according to a 2008 McKinsey study.

How then might we come up with a reasonable way to tether prices without quashing the incentive to innovate? Well, it's complicated. Patent law, gobs of health care legislation, insurance, taxes, lobbyists, ethics—prescription drug costs touch all of them and more. But there are steps we can take to reel prices in. First is shifting away from monopolistic pricing to a more competitive model. Second is designing mechanisms that link the cost of drugs to the value delivered to patients, insurers, society, and even science. The time to move on this issue is now, while the spectacle of a young man named Martin Shkreli is still fresh in mind.

Yeah, that guy. Earlier this year, Shkreli's company, Turing Pharmaceuticals, increased the price of a recently acquired drug from $13.50 to $750 a pill. The medicine, Daraprim, is used to combat parasites, especially for patients with immune-system deficiencies like HIV.

Within a day, Shkreli was being lambasted on every platform and outlet imaginable. His brashness and previous job as a hedge fund manager only made the bull's-eye bigger. "He even looks like a prick," a fellow parent said to me on his way into a PTA meeting in late September.



Turing Pharmaceuticals founder Martin Shkreli raised the price of Daraprim by more than 5,000 percent.

Yet Shkreli wasn't breaking any laws. As physician Peter Bach, director of the Health Policy and Outcomes program at Memorial Sloan Kettering Cancer Center, put it, the Shkreli dustup shows that the system is "so broken even a child could manipulate it."

Bach made headlines in 2012 when he and his colleagues refused to offer patients a new drug because they didn't see sufficient health benefit to justify the $11,000 monthly cost. Weeks later the drugmaker cut the price by 50 percent. It was a rare victory that, like the Shkreli episode, illustrates just how fragile the market for drugs really is. (When Hillary Clinton jumped into the fray with a tweet declaring her intention to do *something* about drug pricing, the Nasdaq Biotechnology Index dropped 5.1 percent.) "Investors know," Bach says. They know that if and when real scrutiny happens, pricing will be revealed for what it is: indefensible.

Contributing editor **David Wolman** (@davidwolman) *is the author of* The End of Money.

IN A TYPICAL marketplace, forces like competition and regulation help keep prices down. You and me? We don't care what it costs to make a saucepan. If the product provides us with value, we'll pay for it. If we can get the same value out of a different saucepan that's half as expensive, we'll buy that one.

The marketplace for medicines in the US is nothing like that. Instead of thinking of drug companies as free-enterprise actors, we should think of them

PAUL TAGGART/BLOOMBERG VIA GETTY IMAGES

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Microsoft Cloud

as "fragile little birds that the protective hand of government carefully shields from the harsh vagaries of truly free, competitive markets," writes Uwe Reinhardt, professor of economics at Princeton. That protection comes in the form of patents and market exclusivity, plus laws against reselling drugs. Rising drug prices across the industry force insurance companies' costs to ratchet up too, despite their best efforts to negotiate better deals. Meanwhile, Medicare, which should have huge bargaining power, isn't permitted to negotiate with manufacturers.

IN EUROPE, REGULATORS REFUSE TO APPROVE DRUGS THAT HAVE A POOR COST-BENEFIT RATIO.

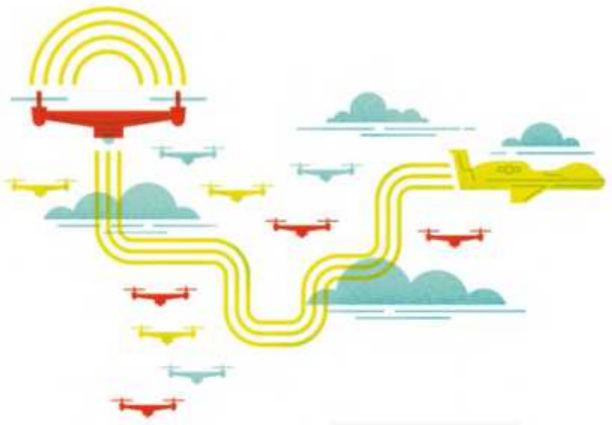
Many European countries have taken a different approach, creating a more robust competitive environment. (Yes, Europe!) If you roll out a new medicine there, regulators will examine how effective it is compared to status quo treatments and set the price accordingly. And they refuse to approve new drugs that have a poor cost-benefit ratio. The specter of refusal alone puts downward pressure on prices.

In the US, an analogous strategy for dealing with drug pricing would be to establish some kind of connection between a drug's price and the value it confers. This past summer, Bach and colleagues at Sloan Kettering introduced an online calculator called DrugAbacus, which compares present-day costs for dozens of cancer drugs with theoretical prices determined by adjustable variables like side effects, R&D costs, predicted years of life added, and the number of people each drug could help. (Other organizations, including the Institute for Clinical and Economic Review, also have a system for calculating value-based pricing.) "This is about finding the right prices," Bach says. "If prices are reasonable, people will be OK to pay them."

It's a start anyway. "I don't know if I'm missing some of the domains," Bach says. "This is going from 'I'd like to price based on values but don't know how' to having some kind of attempt to do so." At a minimum, DrugAbacus and other cost-assessment tools put more information into the marketplace, which is healthy.

In the meantime, don't let up on the Shkrelis of the world. Remember what happened after the avalanche of outrage? He backtracked (some). According to a 2006 paper in the *Rand Journal of Economics*, drug costs are influenced by the mere presence of public debate.

Who knows? Perhaps citizens of the near future will ultimately owe Martin Shkreli a debt of gratitude for inadvertently fast-tracking change to a system that once looked immovable.



JARGON WATCH

gremlin drones
n. pl. /'grem-lin 'drōnz/

Surveillance UAVs designed to be deployed and retrieved by airplane. Swarms of gremlin drones could provide US forces with real-time information about enemy movements. Darpa coined the name to evoke the mythical gremlins that WWII pilots blamed for sabotaging their aircraft.

electrocuring
v. /i-'lek-trə-ˌkyůr-iŋ/

Activating an adhesive with electrical voltage. The first-ever electrocuring glue—which can even form a bond underwater—was recently developed at Singapore's Nanyang Technological University. Potential uses range from shipbuilding to surgically cementing moist tissues.

corkscrew planets
n. pl. /'kȯrk-ˌskrü 'pla-nəts/

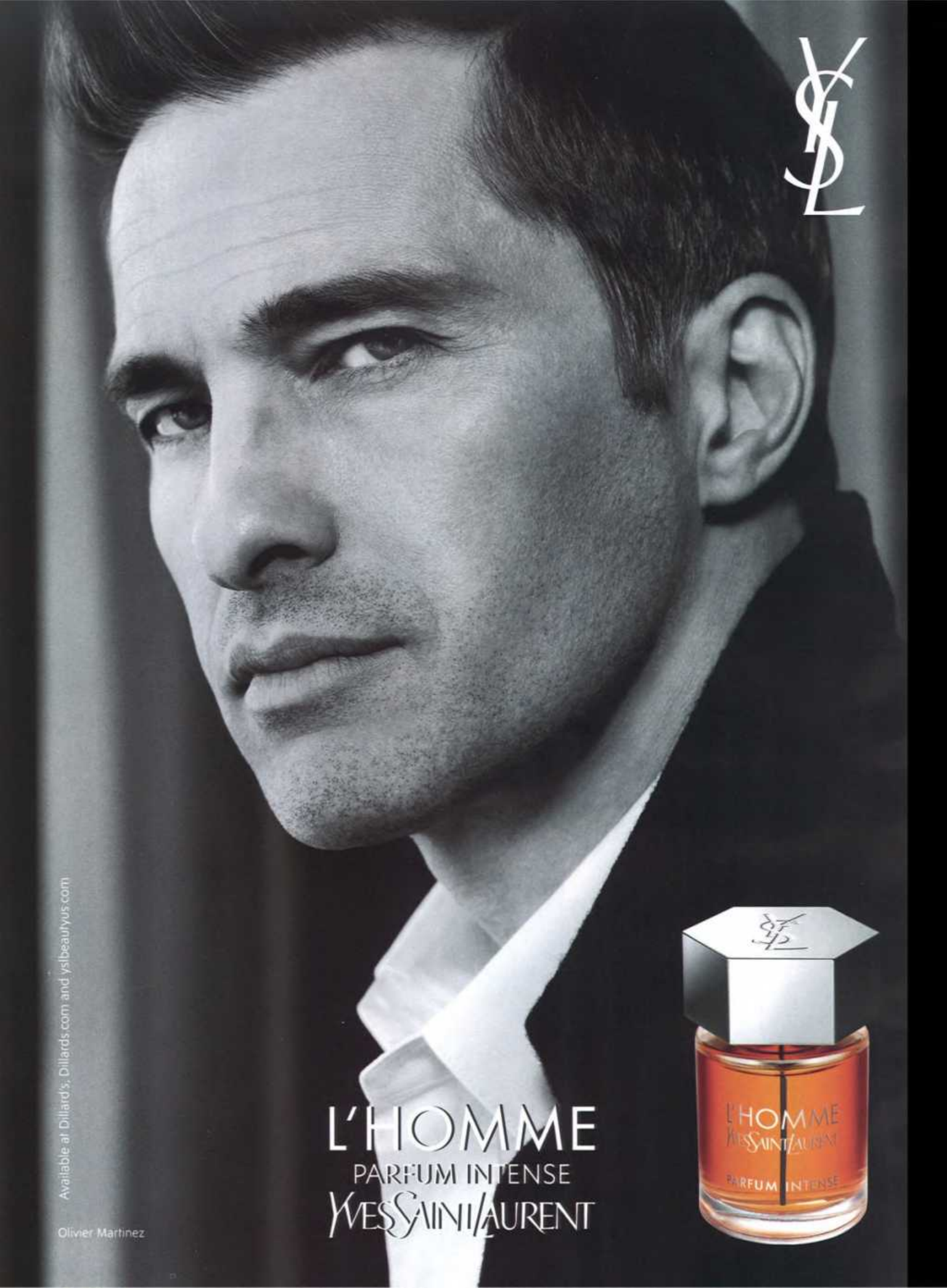
Theoretical exoplanets that spiral between a pair of binary stars. Though life on a corkscrew planet would be weird, with seasons lasting mere hours, their helical orbit would be mathematically stable. Given all the binary stars in the universe, some scientists say undiscovered corkscrew planets almost certainly exist.

sonogenetics
n. /ˌsä-nə-jə-'ne-tiks/

A noninvasive technique that uses sound waves to control the activity of genetically tweaked neurons. Sonogenetics is akin to optogenetics—which lets neuroscientists fire brain cells with flashes of light—but doesn't require fiber-optic cables to be implanted in the brain.

—JONATHON KEATS
jargon@WIRED.*com*

ILLUSTRATION BY PARKO POLO


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YVES SAINT LAURENT
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Kamkar's Greatest Hits

SkyJack
A drone that lets a hacker take control of another drone.

Combo Breaker
A bot that can crack a combination lock in under 30 seconds.

OwnStar
A device that can be planted on a car and used to commandeer the vehicle through its smartphone app.



IN AN AGE when hackers trade techniques on the dark web and sell them to intelligence agencies, Samy Kamkar takes a more entertaining approach: YouTube. A display of the 30-year-old's digital mischief, the video series *Applied Hacking* teaches some 50,000 subscribers flashy hacks, and no household item is immune: He has tweaked a kids' toy to open garage doors, 3-D-printed a Master Lock–cracking robot, devised a fake charger that can sniff keystrokes in wireless keyboards, and even hijacked cars' smartphone apps to remotely unlock and start the vehicles. "I just assume everything is vulnerable," he says. "It's a pretty safe bet." ¶ Kamkar gained notoriety in 2005 as the creator of the Samy worm, viral code that added unwitting MySpace users to his friends list and displayed the text "Samy is my hero" on their profiles. It worked *too* well, ripping through the site and bringing Kamkar a million new friends in 24 hours, along with a visit from very unfriendly Secret Service agents. He pleaded guilty to computer tampering and was banned from using computers for three years. ¶ After that ordeal, Kamkar approaches his research with strict transparency. He says he alerts firms to vulnerabilities in their products but doesn't profit from his hacks and won't accept security consulting work, to avoid conflicts of interest. "I want to do what I think is right," he says. "That's hard when someone's paying you." Instead, he takes his reward from his modest fame—close to 3 million YouTube views so far—and the thrill of solving the hidden puzzles he finds in everything he touches.

—ANDY GREENBERG

JULIAN BERMAN

The new iPhone is here.

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iPhone 6S

With 3D Touch, Live Photos, 7000 series aluminum, A9 chip, advanced cameras, a Retina HD display, and so much more, you'll see how the only thing that's changed is everything.

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TOTAL ELLIPSE
CORNERLESS BILLIARDS



How Loop Works

Every ellipse contains two focus points. In theory, if you hit a ball that's on one focus point (A), it should *always* rebound in such a way that it crosses the other (B). Bellos devised a pool table with a single pocket at one of those focus points.

EIGHT BALL in the corner pocket? Not on Alex Bellos' billiard table. It has no corner pockets—indeed, it has no corners whatsoever. Bellos, a British journalist who covers sports and mathematics, combined his two obsessions to create a unique game that he dubbed Loop. ¶ While working on his book *The Grapes of Math,* Bellos became fascinated by the ellipse. "The shape has these wonderful geometrical properties that we've known about since the ancient Greeks," he says. Instructors frequently illustrate these properties by describing how balls would rebound on an elliptical pool table. Bellos decided to bring that thought experiment to life, refining a set of rules for a two-player game that takes full advantage of the shape. ¶ Loop requires a cue ball, three colored balls, and an elliptical table with one uncharitably small pocket. The billionaire quantitative investor David Harding—a noted benefactor of worthy scientific causes—underwrote the five-figure cost of a single luxuriously appointed Loop table. "If any American billiard companies want to produce more, I'd love to work with them," Bellos says. ¶ The first Loop tournament was held earlier this year, and a Cambridge professor of statistics won after two days of matches. Bellos awarded him the coveted Golden Cone—a spray-painted piece of Styrofoam. But we're sure the real honor is in being champion of the geekiest sport ever. —CHRIS BAKER

ANGRY NERD

F&#K IT, WE'LL DO IT LIVE!



In December, the coolest sci-fi/fantasy epic of the 1970s is finally getting the high-profile revival it so richly deserves. If you're as excited as I am, yell it with me: *The Wiz Live*! What, you thought I was talking about something else? Nope. The all-black reimagining of the classic L. Frank Baum book was the toast of Broadway when it first appeared, and it remains *the* great cultural touchstone of the Gerald Ford era. (How many Tony Awards did *Star Wars* ever win? *None*, that's how many.) Now *The Wiz* strikes back as the latest musical broadcast live on NBC—and it gets even better, because next month Fox is jumping on the trend by staging *Grease*. This is exactly the sort of high-risk, high-reward programming we need. When it's good, the added immediacy makes it transcendent. And when it's terrible? Oh, sweet *Freejack*, it's gloriously, unforgettably terrible. Watching a live musical on TV is like being at a Nascar race—things are always one flat tire (or note) away from disaster. Now *that's* what I call must-see TV. Listen up, NBC: If you want to up the ante, I've got two words for your 2016 live holiday musical—*Captain EO*! Don't worry about issuing a check. Just pay me in Warhammer 40K figurines.

LOL. KEEGAN (LOOP TABLE); ILLUSTRATION BY ZOHAR LAZAR


sip
pitch
fast-track
up
up
up
smartwater
vapor-distilled water, inspired by the clouds.
drinksmartwater.com

GEAR SHIFT
AN OVERHAULED CAR SHOW

THE BUILDING THAT houses the Petersen Automotive Museum in Los Angeles was never meant for cars. Originally designed as a department store, the '60s-era Brutalist monolith had an awkward floor plan and a freight elevator better suited for ferrying kitchen appliances than, say, a Rolls-Royce Phantom. Which is why the two-decade-old museum shut down for 13 months of massive renovations. When the Petersen reopens in December, it won't be some refurbished garage you're stepping into—everything from the exterior to the display areas to the tech that permeates the space has been given a 21st-century tune-up (to the tune of $125 million). It's like a shiny new supercar, captivating inside and out. —NICOLAS STECHER

A Heavier Lift

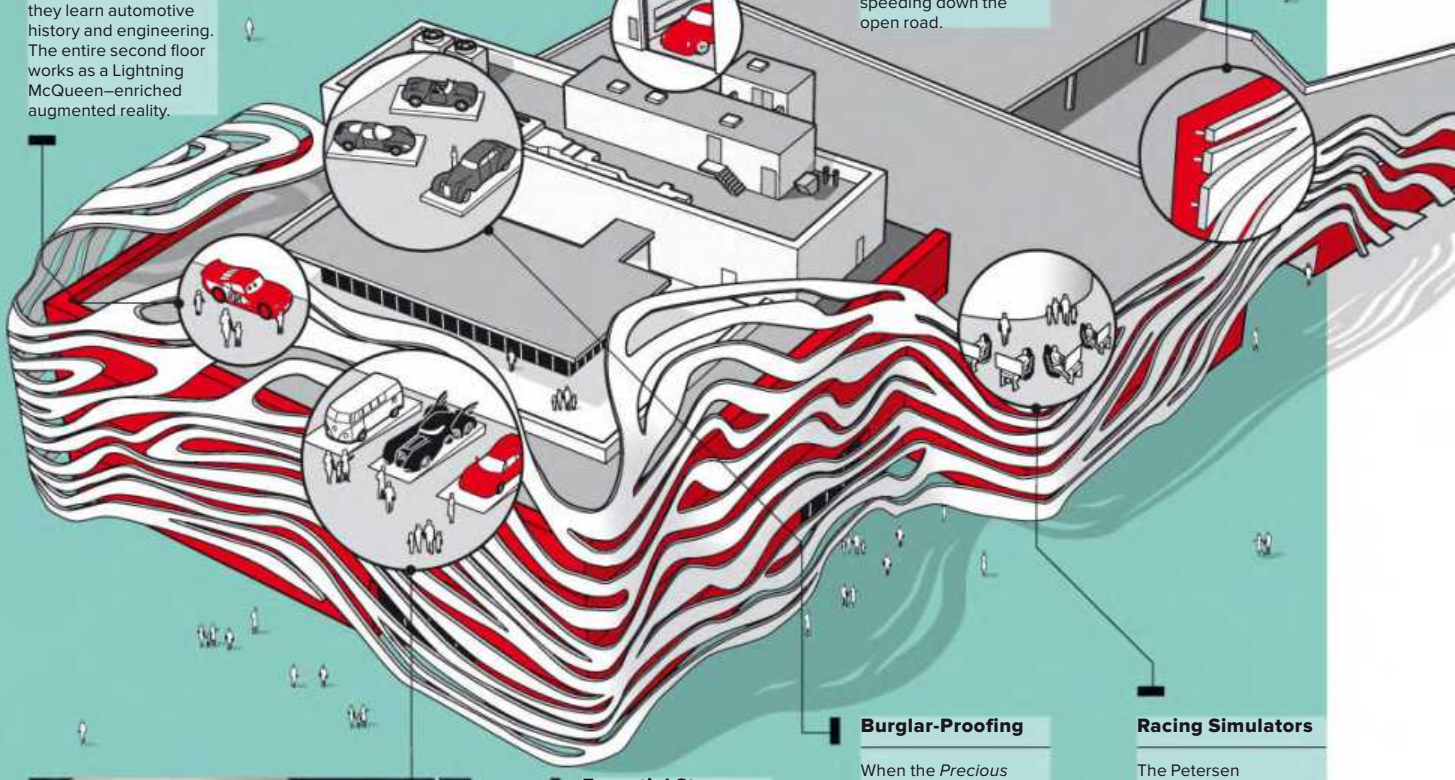
The new $3.2 million freight elevator is big enough to carry the yachtlike 1925 "Round Door" Rolls-Royce Phantom. At 12 by 24 feet, it's one of the largest lifts in Los Angeles, with a weight capacity of more than 7 tons. (Visitors will get remodeled elevators of their very own.)

Pixar Playroom

Kids can use tablets in the Pixar Mechanical Institute to interact with characters from the *Cars* films, working their way through six stations as they learn automotive history and engineering. The entire second floor works as a Lightning McQueen–enriched augmented reality.

Flowing Facade

The new exterior is wrapped in 100 tons of undulating stainless steel ribbons and glowing backlights, evoking the thrill of speeding down the open road.





Essential Stops

The third floor's Hollywood Gallery will showcase famous vehicles—James Bond's Jaguar C-X75 from *Spectre* alongside the *Breaking Bad* Aztec, for instance—while the Mullin Grand Salon on the first floor contains a 166-foot cinematic wall that seamlessly blends 16 projectors.

Burglar-Proofing

When the *Precious Metals* exhibit opens—featuring 12 super-sexy silver-painted cars—the insured value of that one room alone will top $100 million. Heisters beware: 68 miles of Cat 6 cable, 85 interior and exterior security cameras, keyscan access-control units, and 24-hour patrols will ensure the Duesenbergs and Bentleys stay safe.

Racing Simulators

The Petersen collaborated with Xbox and the *Forza Motorsport* videogame franchise to outfit the museum with 10 racing simulators. Plans are in the works to host competitions, including a 24 Hours of Le Mans event running parallel with the actual race.


Turn on the lights.
Reorder light bulbs.
What's on my calendar today?
Who is Nikola Tesla?
Connected to your life.
Controlled by your voice.
Hands-free and always on to read the news, answer questions, play music, check traffic, weather and much more. Just ask.
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UNVEILED VOICES
MUSLIM WOMEN SPEAK OUT

YOU KNOW YOU'VE REACHED peak Islamophobia when a presidential candidate says he'd be uncomfortable with a Muslim in the White House. In response to Ben Carson, Twitter user (and Libyan-American Muslim woman) Hend Amry pointed and laughed, launching the hashtag #HowToStopAMuslimPresident. (First idea: all-bacon White House.) She's one of a growing number of Muslim women who are using social media (and a healthy dose of humor) to speak truth to preconceptions. —OMAR MOUALLEM



Hend Amry
@libyaliberty

When Bill Maher claimed that ISIS fighters aren't outliers in their violence, she tweeted, "Five of the last 12 Nobel Peace Prize winners were Muslim. So according to Bill Maher, we're all Peace Prize winners!" It was retweeted more than 7,800 times. But her best joke was that Princess Leia is a headscarf short of being "sharia-compliant."

Sana Saeed
@sanasaeed

A producer at AJ+, Al Jazeera's all-digital, Facebook-centric channel, she coined the term "faithwashing": when people say conflicts like Israel and Palestine's are merely religious. Social media, she says, "allows all of us Muslim women—who veil, don't veil, veil sometimes, veil everything, veil very little—to critique popular representations."

Tanzila Ahmed and Zahra Noorbakhsh
***#GoodMuslimBadMuslim* podcast**

"There are so many things I didn't know about being Muslim until the media told me about it," quips Noorbakhsh on this podcast. Ahmed is most proud of how many younger women they reach with their chatty format: "We speak to them in a way that no one has before."

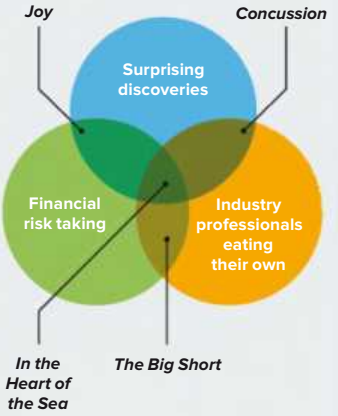
Zainab Bint Younus
***The Salafi Feminist* blog**

Responding to the concerns that women in niqabs need rescuing, this Canadian blogger—who wears the face covering—collected selfies from others like her. The results? Pretty boring ... if you think covered ladies playing street hockey and riding Jet Skis are boring.

JOE MCKENDRY

CHARTGEIST

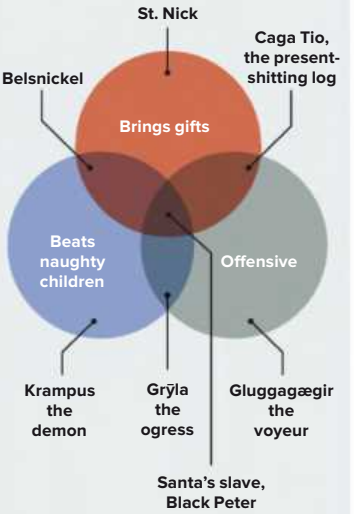
December Movies Based on True Stories



Commerce



Folkloric Christmas Characters



CHARTGEIST CONTRIBUTORS: CHRIS BAKER, JON J. EILENBERG



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WE'RE LIVING THROUGH AN ERA OF RAPID URBANISATION. BUT HOW DO WE MAKE SURE THE CITIES WE CALL HOME GROW SUSTAINABLY, RESPONSIBLY AND WITH THE FUTURE WELL-BEING OF CITIZENS TAKEN INTO CONSIDERATION?

FUTURE CITIES



"One day, I think historians will refer to the period of 1950 to 2050 as the century of the city," says Shell vice president global business environment Jeremy Bentham. "Urbanisation is one of the greatest social phenomena of our times."

Research shows that more than half the world's seven billion inhabitants lived in cities in 2008. By 2050, about three-quarters of us will, as the population grows from seven to nine billion. By then, urban infrastructure equivalent to a new city of more than 1.4 million people will have been built every week.

With more of us living in urban areas, we need smart energy ideas in action to deal with the issues that emerge from city growth, such as energy demand, congestion, and population density, to name just a few.

Bentham oversees a team who work on scenario-development projects that combine in-depth research and futurism to "help stretch and extend the thinking of Shell decision executives," he says.

One of these "memories of the future", as Bentham refers to them, entitled *New Lenses on Future Cities*, deals with the broad issues surrounding urban development.

"We've learned that city development patterns are key drivers of future demand for energy and other resources. If you're going to understand energy demand, you have to understand urban development."

One of the clearest takeaways of the research – which was produced in collaboration with Singapore's Centre for Liveable Cities – is that compact cities, such as Singapore and Hong Kong, are generally more energy-efficient and produce fewer emissions than sprawling cities like Los Angeles.

"If you compare the energy use per capita for personal transport, the United States uses three times as much energy as Europe," says Bentham. "Part of that is because Americans tend to have bigger, heavier vehicles on average, but the main reason it is that they travel twice as far as Europeans."

Bentham's team has highlighted five areas that, if successfully implemented, can create well-managed urban growth. And, if bungled, can cause problems for a city's future. Factors which lead to what Bentham calls "room to manoeuvre" include flexible long-term planning, investment in the future, the ability to build trust, capacity to implement projects and public/private collaboration.

In Singapore in the 60s, a quarter of the 1.6 million population lived below the poverty line. A quarter of a million lived in city centre slums – and even more in squats. Public hygiene was poor and malaria and tuberculosis widespread. Unemployment rates rose from five per cent in 1957 to 14 per cent 1959.

In the following decades, new urban planning initiatives factored in unexpected population growth. Restrictions on cars in the city centre were imposed and public transport invested in. To boost housing, red tape was slashed and strong land-acquisition laws and powers of resettlement enacted. By the mid-60s, Singapore could build the equivalent of one flat every 45 minutes.

In 2015, the *World Happiness Report* announced that Singapore was the highest-ranking country in Asia in terms of the happiness of its citizens.

London is often praised for its ability to move with the times. So does it adhere to Bentham's list of factors that might give it room to manoeuvre?

"IF YOU'RE GOING TO UNDERSTAND ENERGY DEMAND, YOU HAVE TO UNDERSTAND URBAN DEVELOPMENT"



How the London of tomorrow could look if the city continues to thrive. To do so its urban planners will have to ensure the city has room to manoeuvre if challenges and crises strike.

In terms of flexible long-term planning, the city mayor, Boris Johnson, recently published several reports on the capital's future, including the *London Infrastructure Plan 2050 – A Consultation*. This detailed document summarizes how City Hall intends to deal with population growth, incorporate new technologies and innovation, manage infrastructure and resources, upgrade its transportation systems and much more. Investment in the future includes 200km of new cycle highways and deploying 5G.

In terms of trust, the fact that international businesses and citizens alike flock to the city is evidence of that. The London 2012 Summer Olympics is widely seen as having been a success; Crossrail, the largest addition to the rail network of south-east England in 50 years, is due in 2018 and 2019. Many of these are collaborative projects uniting civic discourse, business and government.

But what of cities elsewhere? One report from Shell is entitled *Challenges & Opportunities for Marikina City* – a study of a small city in the Philippines. The collaboration aims to understand its situation, future challenges and energy needs, and to identify key constraints, as well as aspirations of the city. Finally, it brings together global expertise and local knowledge to create a set of options to help the city to tackle the energy and transport challenges it faces.

The conclusion suggests the development of a distributed energy system that works in combination with the existing grid, boosting of the aesthetic appeal of the city's river, and using infrastructure projects to bolster flood defences. It also proposes new efficient transport systems.

That's not the only Shell collaboration. In China, it has a two-year agreement with the Central Government's think tank, the Development Research Centre under the Chinese State Council, to undertake studies into the country's energy strategies.

Shell is also one of the world's largest suppliers of natural gas and LNG – a fuel that can be liquefied to provide an economical fuel for power generation. Replacing coal-fired power stations with gas technology could cut power plant CO_2 emissions by 90 per cent, if combined with carbon capture and storage.

But ultimately the success of our future cities depends on collaboration across all aspects of society that works for the benefit of all of us – and our home planet.

TOOLS TO BUILD FUTURE CITIES



These are the conditions that lead to cities having room to manoeuvre when faced with a crisis:



Ability to build trust
To thrive cities must gain the trust of potential citizens and businesses.



Flexible long-term planning
Major projects and initiatives must be flexible and adaptive if they're to succeed.



Collaborate Effectively
All sections of society should work together to overcome problems



Invest in the future
Cities must invest in education, capacity and innovation – like businesses do.



Capacity to implement
Policies will succeed if executed using the right mix of people, goals and support.

Q:

IS FLIRTING ON LINKEDIN LESS WEIRD THAN ON OTHER SOCIAL MEDIA? AFTER ALL, YOUR RESUME VOUCHES FOR YOU IN A SUBSTANTIVE WAY.

BY JON MOOALLEM

A: Whoa. Hang on. Let's first poke at the premise of your question, because the implications here are huge. Notice how you casually presume your résumé offers a more *substantive* representation of your basic humanity than, say, all the tweets you've tweeted or all the digital artifacts amassed on your Facebook page. Think of the photos on Facebook alone: You in a rowboat with the gentle-looking man playing a banjo whom we understand to be your deceased (too young) father. You being silly—but not obnoxiously silly, just innocently, endearingly silly—in the Halloween aisle of a big-box store. You tagged in a photo of that kid you mentored that one summer, as he graduates from Berkeley. You climbing a goddamned mountain! Like, with pickaxes and stuff! ¶ Do these not substantively communicate the substance of your life? Don't they "vouch" for you to potential dates as a safe, noncreepy, sufficiently together human being, a sympathetic soul tumbling through the fundamental experience of being alive and looking for companionship? Or is that better captured with a line like this: "January 2013–November 2014, Senior Operations Associate, Mobitly Inc."?



CHRISTOPH NIEMANN

You seem to think it is. And I'll admit—begrudgingly—that you may have a point. Because the lines have been blurred between our work lives and our emotional lives, our careers and our intrinsic selves. We subconsciously gauge a person's character by their professional standing, and our experiences and attitude toward our work aren't only *sometimes* relevant to our love lives. In fact, the two can feel crucially interwoven: The best startup founders are those who operate out of *passion* and *devotion* and with a kind of hyper-monogamous *obsession*. On the other hand, we all feel obligated to *work* on our relationships with the same myopic, idealistic intensity. And it can feel natural to apply the lessons we learn relating to people in one realm to our relationships in the other.

Take, for example, Jeff Weiner, LinkedIn's CEO. I confess, I'm not a LinkedIn user, but I've been reading up on Weiner and, I have to say, he seems like a wonderful guy—a principled, thoughtful man who says very grounded, Jerry Maguire–type things like, "I've never been title-driven; for the most part, I've been *purpose*-driven." He also reads books by the Dalai Lama, contemplates the difference between compassion and empathy, and practices mindfulness techniques like "being a spectator to my own thoughts," which enhance his ability to relate to and motivate his employees. He calls his style "compassionate management."

In an essay he wrote a few years ago, Weiner described leaving work one evening, feeling proud of the strides he'd made as a compassionate manager, only to be felled by the epiphany that he'd been very uncompassionately neglecting his wife. He was working so hard, he wrote, that at night, "when my wife would try to bring up her day, or talk about the things we need to get done, I would reflexively say something to the effect that it had been a long day, I was exhausted, and could we talk about it some other time?" In other words: "For as hard as I worked to manage compassionately at the office, I was not always actively applying the same approach with my family." So Weiner applied the same compassionate management style to his marriage and made things right.

I worry that sounds off, like the emotionally tone-deaf insights of a stereotypical tech baron. But trust me, the



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way Weiner explained it, it sounded cool—*real.* (And know this too: Worried that I'd gush in this column about Weiner's coolness and realness only to learn later that Weiner is actually not cool and not real and is, in truth, as imperious as Genghis Khan or a Grade A, misogynistic, steroidal jerk, I sat down and Googled "Jeff Weiner LinkedIn jerk" and was happy to find, as the first result, a post singling him out as a "counterweight" to the industry's many other CEO-jerks. So that was reassuring—even if the post was published on LinkedIn. But even *that* can be interpreted as a testament to Weiner's character, because it was Weiner, I learned, who had the vision to expand LinkedIn from a bland résumé farm into a successful publishing platform.)

I'll go even further. I wouldn't be surprised if a man as smart as Weiner already knows all this, knows that we live in an age where one of the prime, romantically reassuring things about another person—the thing that "vouches" for them best as a potential mate—is that they're a trustworthy, hardworking, successful employee. And therefore, he also secretly knows that LinkedIn could be the *ultimate* dating site, though he wisely stops short of saying it. Instead, he just dog-whistles about that potential to attentive users and eagle-eyed investors, thus preserving the opportunity to pivot the company explicitly in that direction should the climate change and the need arise. Recently, for example, he told an interviewer, "Our core value proposition to members is to help them connect to opportunity," and touted "the power of this as a platform to enable capital"—especially "human capital"—"to flow where it can best be leveraged."

Isn't he talking about dating, about setting people up? When Tevye and Golde's daughters sang, "Matchmaker, matchmaker, make me a match," weren't they basically asking a kind of social networking platform to send their own human capital flowing toward whichever shtetl boy would give it the highest valuation and invest? Why shouldn't you flirt on LinkedIn? Why shouldn't love be one of the opportunities LinkedIn connects us with?

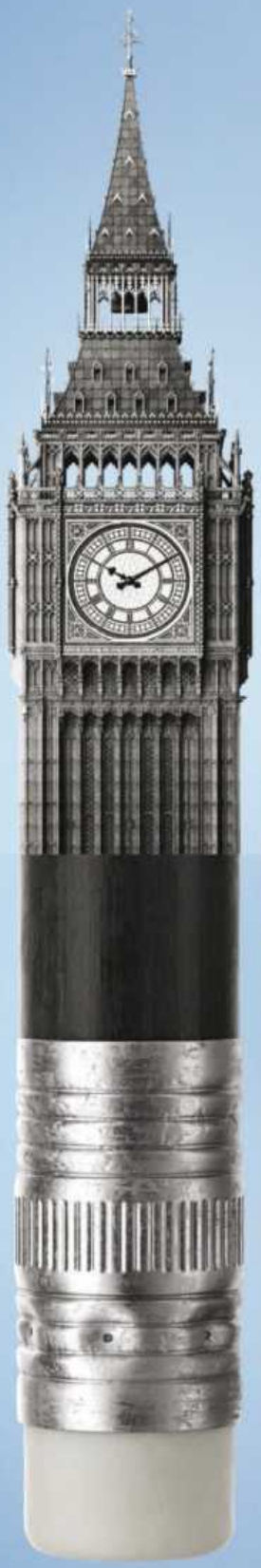
So, yes. You are right. And you've taught me a lot—you and Jeff Weiner both. I can see clearly now how we've all tied ourselves into a knot of careerism and affection and equity and sex, and maybe that's just the way it has to be. I'm remembering now what happened when Jerry Maguire—the real Jerry Maguire—showed up in that living room, shivering, trying to win back his wife, who also happened to be his business partner at their new sports-agenting startup, how he told her, "You … you complete me." But, more important, there was the line he slipped her right before that famous line. Suddenly, in the middle of his monologue, he was compelled to say, like a man giving a keynote at a conference, "We live in a cynical world, a cynical world, and we work in a business of tough competitors."

Why? Why include *that*? What could Jerry Maguire possibly have meant? I think he meant: *The Internet is full of sinister strangers. It's a hostile place in which to offer up your soul. But here I am. Look at me. View my profile. I'd like to connect with you on LinkedIn.* W

A SEEING-EYE CANE
BUZZY HELP FOR THE BLIND

Every day, Indirani Sankari, a petite 23-year-old schoolteacher in Mumbai, commutes between a western suburb and the city's southeastern edge. The trek takes two hours, three trains, and a lot of walking—each way. But that's not the most painful part. Sankari is visually impaired, and her route is a gauntlet of threats: signboards, glass doors, benches, stray animals. "I've been attacked by dogs and cows, and I've been hurt everywhere," she says. In the past year, though, Sankari has managed to get to and from work largely unscathed. For this, she thanks her SmartCane, a device that sits atop her regular walking stick and uses ultrasonic beams to scan her surroundings. Whenever she approaches an obstacle, the contraption buzzes against her palm, intensifying the vibrations the closer she gets. The SmartCane was developed by computer scientist Rohan Paul when he was an undergrad at the Indian Institute of Technology Delhi. After nearly a decade of testing, the device launched last year; all or part of its $50 cost is often subsidized by nonprofits or the government, and so far 10,000 Indians have picked one up. Now a postdoc at MIT's AI lab, Paul is expanding distribution to other countries, including Thailand, Qatar, Iran, Ghana, and Ethiopia. He relies, he says, on the word of mouth of satisfied customers. Sankari is certainly one: She swears people can no longer tell she's impaired at all.
—SHRUTI RAVINDRAN





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WHAT'S INSIDE

FEBREZE AIR EFFECTS JOLLY PINE CASTOR OIL AND SUGAR RINGS



THE VOORHES

Cyclodextrin

One of the key ingredients that help Febreze keep your stench in check. The hydrophobic core of this sugar ring attracts certain volatile aromas—like of rancid grease—and traps them inside its funnel shape. Make no mistake, you can still inhale the smelly stuff—it's just walled off from your olfactory receptors.

Nitrogen

The main component of Earth's atmosphere is compressed to help deliver a spray of mist from the nozzle. This is a friendly alternative to ozone-depleting CFCs. Plus, nitrogen gas isn't flammable—although some of the other ingredients in Febreze can be, so don't go spraying it on a lit menorah or the Yule log.

Hydrogenated Castor Oil

This emulsifier, derived from castor beans—which are actually poisonous seeds, but that's another story—has bonus –OH groups that help reduce the overall surface tension of this formula, so the contents mix well.

Denatured Ethanol

Febreze is water-based; ethanol serves as a drying aid to help the H_2O evaporate quickly after spraying.

Polyacrylic and Hydrochloric Acids

When mixed with water, these form solutions that can literally neutralize odors—they bring the pH levels of acidic smells (like BO) and basic smells (like rotten fish) into a balanced and unpungent pH range.

Perfume Blend

If your fragrance is a trade secret, you don't have to disclose ingredients. We do know that one class of compounds commonly found in fragrances has raised red flags: synthetic musks, which spark worries about potential endocrine disruption and wildlife toxicity. Not to sound like an olfactory grinch, but maybe just go fragrance-free.
—BLANCA MYERS

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TWO PHOTOGRAPHERS, THREE DESTINATIONS

WIRED Brand Lab and Victorinox tapped into two seasoned photographers as they embarked on the trip of a lifetime. @chrisozer and @samhorine met up at the Victorinox Store in Soho, NY, geared up for their adventures—including everything from apparel and cutlery to luggage and the latest timepieces—and headed out to their respective destinations. After some quality time spent in the Hudson Valley and at Rockaway Beach, Chris and Sam reconnected and headed to Ibach, Switzerland, home to Victorinox's headquarters. While there, they took in the breathtaking views of Lake Lucerne, explored the Victorinox factory and hiked around Mount Rigi. To explore more from Chris and Sam's adventure and see additional photographs visit wired.com/brandlab/victorinoxadventures. To shop Victorinox products visit Victorinox.com.

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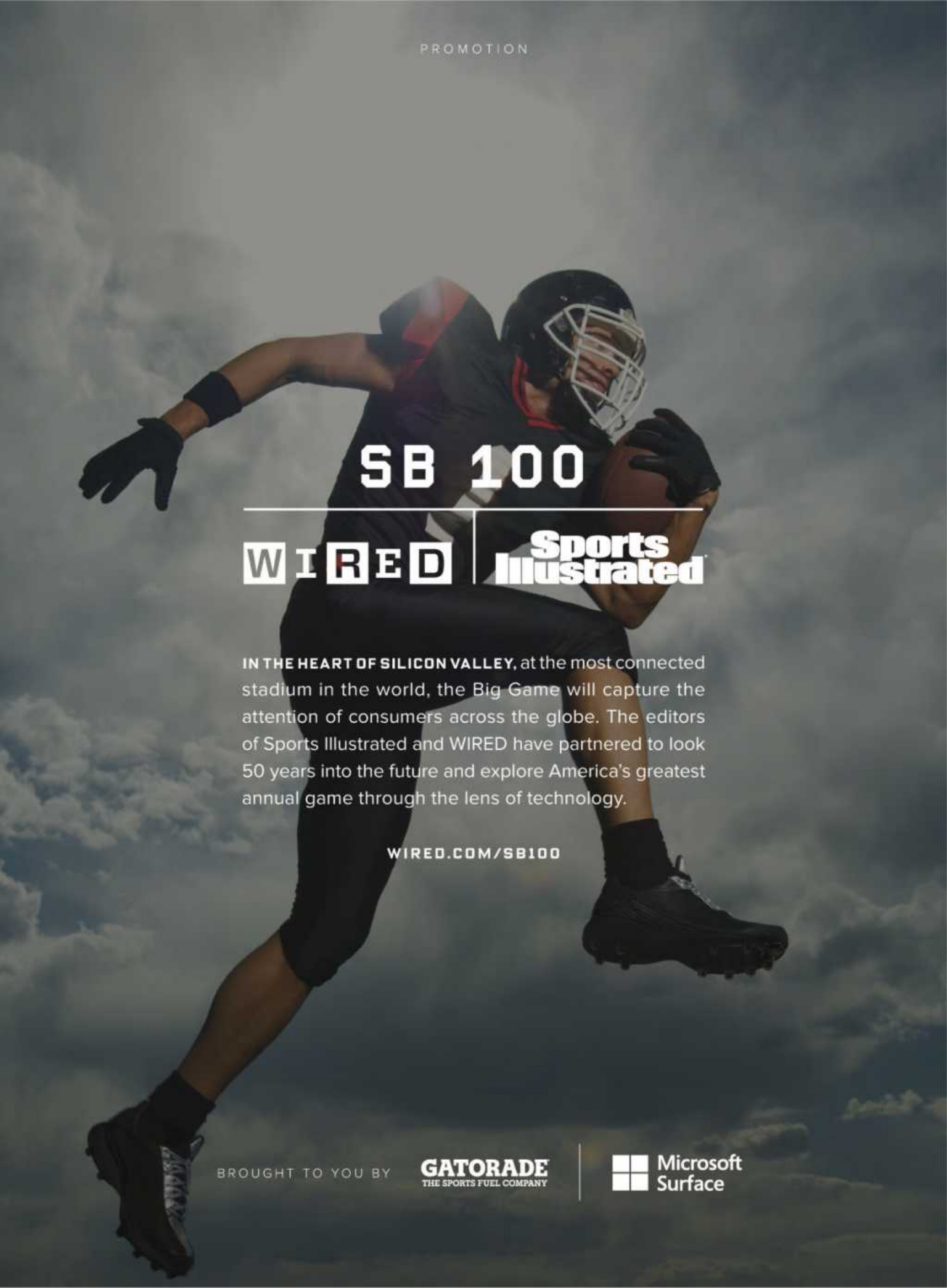


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WIRED CITIES

HOT SUN IN THE WINTERTIME
SWAP SEASONS IN MELBOURNE



The undulating, sand dune–inspired rooftop of Southern Cross Station dissipates train fumes and cools platforms.



"Ice-cold drinks, shorts, clean shirts, and a seafood buffet feast—that sums up Christmas for me. I remember heading to Nevermind Bar on Christmas Eve, spinning music all night long on the roof deck until nobody was left."
—Nicholas Murphy, aka Chet Faker, electronic musician

THIS HOLIDAY SEASON, banish all thoughts of eggnog and log fires. When you spend December in Melbourne, it's gourmet barbecues by the river and impromptu park parties until sunrise. (And don't forget to leave a craft beer out for Santa.) Along with its world-class dining, vibrant street art, and *heaving* music scene, Australia's cultural epicenter is building a reputation for "getting shit done," says entrepreneur Matt Allen, who runs the local branch of the Founder Institute. "The thriving ecosystem of meetups, coworking spaces, and like-minded people is creating a feeling that this is the place to be." Well, that and the promise of a white Christmas—warm, white sand, that is. —SOPHIE GOSPER



See

Marvel at the dreamy symmetry of the **Central Business District** from a hot-air balloon. Then visit the **National Gallery of Victoria** to see Emily Kam Kngwarray's 9- by 26-foot *Big Yam Dreaming*, the cornerstone of modern Aboriginal art. As you wander the city, lose yourself in the gloriously graffitied **colonial laneways** or sip high tea and browse vintage boutiques at the **Block Arcade**. Drive an hour out of town to gaze at the plunging cliffs of the **Great Ocean Road**; trek a bit farther to witness the rugged **Twelve Apostles** rising from the swells.



Do

Join the convoys of festivalgoers as they pilgrimage down the coast to the **Falls** or **Meredith music festivals**. When you're back, rent a bike and ride along the **Yarra River**. Find a spot on the bank, in the shade of the **Royal Botanic Gardens**, and make friends with a band of Christmas revelers (they'll likely be serving up sausages in bread with ice-cold cans). From here you can take in the city's sporting heritage: the **Melbourne Cricket Ground**, shrine to the 1956 Olympics. It's also home to the **Boxing Day Test**, an annual cricket match that captivates the country.



Eat

Nibble salt-cod croquettes and drink Spanish red at the beloved tapas hot spot **MoVida**. Yum cha is a brunch staple for locals—visit **China Town** and allow yourself to be ushered into any restaurant for endless plates of dumplings and pork buns. At night, feast at **Cookie**, a Thai restaurant and beer hall. Then head upstairs to **Rooftop Bar** for cocktails, tunes, and Gotham-esque views.

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LOOK WHO'S TALKING

WHOLE NEW WAYS FOR ANIMALS TO SPEAK

IMAGINE YOU'RE A DIABETIC and you use a service dog trained to alert you if it senses your blood sugar is falling. These dogs are incredibly useful, because diabetics can lapse into "hypoglycemia unawareness," where they don't notice their own oncoming symptoms. The canines do, and they intervene. But sometimes a diabetic shock can emerge so suddenly the human passes out. Then the dog's in a quandary: How does it go for help? Because dogs can't talk. ¶ Unless they're sporting a wearable computer that helps dogs communicate with humans. Melody Jackson, a computer scientist at Georgia Tech, has been outfitting service dogs with computerized vests, so that in an emergency they can find another human and pull a mechanical lever on the vest that triggers an audio message: *My handler needs you to come with me!* ¶ When people hear this for the first time, "they jump back 3 feet, because the dog is talking," Jackson says, laughing. The dog can also do other tricks with its wearable, like triggering an SOS alert with GPS coordinates. A search-and-rescue dog could do the same. It's all part of a curious new field called animal-computer interaction. ¶ And it's not just dogs. Scientists are making systems to help humans and dolphins communicate; others are crafting cat-human videogames, and Jackson is making sensors that monitor horses and broadcast signs of impending lameness.

But as you might imagine, the big action is, yeah, with canines, who seem *super stoked* to get a doggie version of Google Glass. Dogs are, after all, highly social and already involved in assisting humans. Giving them more ways to talk to us is a no-brainer. For example, if seeing-eye dogs notice an obstacle, they can use Jackson's vest to tell their human what type of obstacle it is, a feat that was previously extremely difficult.

There's something to be learned here about designing for humans, too. Making tech for animals means paying extremely close attention to the ... uh ... end user, because animals can't give detailed feedback. If you get it wrong, you can't paper it over with clever marketing. You have to work within the animals' capabilities.

For dogs that means making interfaces suited for prehensile mouths and sensitive noses. Clara Mancini, head of the Animal-Computer Interaction Lab at the UK's Open University, devised a sensor that measures the sniffing pattern of cancer-detecting dogs as they assess samples, an indicator of how strong a scent they're picking up. When Jackson made a touchpad for service dogs to use in conjunction with her vest, the pups discovered it would pick up a signal if they just hovered their nose over the pad. (One deduced this in 27 seconds. Humans aren't alone in our technological prowess, it seems.) The point is, with the right interface, animals can tell us all kinds of things.

Of course, we might not always like what they have to say. What if zoo animals could tell us how they're doing? Imagine giving industrially farmed chickens, pigs, and cows the means to communicate their comfort level. "Many farmers don't want to know what's going on with their animals," Mancini says. Consumers might not either.

None of the millions of dollars we've spent trying to communicate with intelligent aliens has paid a return. And now it turns out the first extraspecies high tech communication will come from creatures that share our living rooms. The day may come soon when your dog texts you at work. What's the emoji for "Sorry I ate the rug"? W

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WISH LIST

64 of the coolest products for giving, getting, and drooling over this holiday season.

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GOOD LUX

PHILIPS HUE GO $100

WHO WOULDN'T WANT A LITTLE PORTABLE BOWL OF COLORED LIGHT? THE HUE GO HAS A BUILT-IN RECHARGEABLE BATTERY, SO YOU CAN RUN IT OFF AN OUTLET AT DINNER, THEN TAKE IT WITH YOU WHEN THE PARTY MOVES TO THE BACK PORCH. THE LED ARRAY INSIDE PRODUCES 16 MILLION COLORS, LETTING YOU MATCH THE MOOD TO THE MOMENT.

COASTERS	**$7**
BACKGAMMON	**$23**
COCKTAIL BOOK	**$35**
SERVING TRAY	**$40**
UNBREAKABLE GLASSES	**$50**
TERRA-COTTA CARAFE	**$65**
ICE BUCKET	**$90**
PORTABLE LIGHT	**$100**
DARTS	**$132**
COCKTAIL SHAKER	**$135**
DARTBOARD	**$140**
INSTANT CAMERA	**$169**
UE BOOM SPEAKER	**$199**
CITRUS PRESS	**$200**
SONOS SPEAKER	**$499**
B&W SPEAKER	**$699**

Entertaining is about the little things: the right lighting, the awesome playlist, the perfect glasses for that punch you've been concocting. Set the stage with care and the good times will take care of themselves.

STAR WARS™

Disney

THIS IS THE DROID YOU'RE LOOKING FOR

Meet BB-8™ – The app-enabled Droid whose movements and personality are as authentic as they are advanced. BB-8 responds when you speak, expresses different traits, and rolls under your control or on its own. The magic this Droid creates is unlike anything you've ever experienced. It's more than a toy – it's your companion.

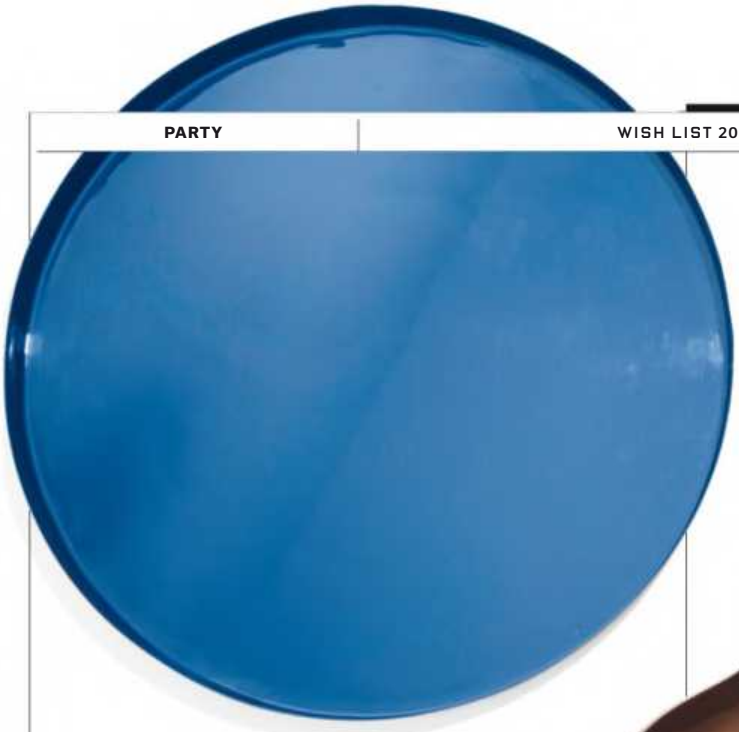




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BB-8™ APP-ENABLED DROID™

sphero.com



NICE SERVE

CB2 ROY TRAY **$40 AND UP**

This eye-catching iron tray adds a dash of sophistication to any gathering, whether you're serving hors d'oeuvres or a fancy nightcap. Raw metal on the outside, enameled blue or ivory inside, it could make even a couple of PBRs look classy.





SURFACE PROS

IKEA GROGGY COASTERS
$7 FOR 6

COASTERS HAVE A SIMPLE JOB: TO PROTECT YOUR TABLETOPS FROM NICKS AND WATER RINGS. YOU COULD SPEND A LOT MORE, BUT THESE STAINLESS STEEL SQUARES, WITH THEIR PADDED BASE AND CLINGY CENTER, GET THE JOB DONE AND LOOK SHARP DOING IT.

Quick Pics

LOMO'INSTANT SANREMO **$169**

The whole point of an instant camera is to deliver photos ... instantly. That doesn't have to mean low quality, though. This one comes with portrait and 170-degree fish-eye lens attachments, along with a built-in 27mm-equivalent wide-angle, variable exposure controls, and a maximum aperture of f/8. You'll be the life of the photo party.



Not Stirred

TOM DIXON PLUM COCKTAIL SHAKER **$135**

The sci-fi look of this copper-plated cocktail shaker might throw you, but the instructions for using it are the same as always: Fill with booze, add ice, and agitate. Don't be surprised, however, if you draw an audience.

GIVE THE GIFT OF TIME WELL SPENT

THE MACALLAN RARE CASK IS THE GIFT OF TRUE RARITY. CAREFULLY SELECTED FROM LESS THAN 1% OF THE MACALLAN'S FINEST SHERRY OAK CASKS, THIS COMPLEX EXPRESSION IS A CELEBRATION OF OUR TIME-HONORED TRADITION. MAKE IT A PART OF YOURS THIS HOLIDAY SEASON.



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Meet The New Beats Pill+

The Beats Pill+ portable wireless speaker is designed to go wherever you do and fill the room with a rich clear sound field that has as much power as it does definition. With a sleek interface, the Beats Pill+ is intuitive to use.

We dare you to turn it on and hear for yourself.

Sound

Stereo active 2-way crossover system creates an optimized sound field for dynamic range and clarity across all genres of music



Life

Keep track of your power levels with the fuel gauge so you always know how much battery is left

To learn more, check out
beatsbydre.com/beatspill+

Style

Tweeter and woofer separation uses the same acoustic mechanics found in professional recording studios

Play, pause, skip tracks, and control your phone calls with a touch of the multi-function button

With its sophisticated design, Beats Pill* looks as good as it sounds

The simple, intuitive no-nonsense interface gets you to your music fast



The 12-hour rechargeable battery means you can stay charged on the go

Built-in speaker phone allows you to make and receive calls with clarity

Play

Download the Beats Pill* app to unlock features that put you and your friends at the center of your music like never before

*Available on iOS and Android.

DJ

AMPLIFY

STEREO





Get a Grip

ITALESSE FRESNEL PARTY GLASSES **$50 FOR 6**

Some people can't hold their liquor; you don't want them dropping glasses at your big pool party. These polycarbonate tumblers are unbreakable, and the elegant ridges on the side, inspired by the Fresnel lenses in lighthouses, make them less slippy.



Spirit Guide

LIQUID INTELLIGENCE **$35**

Making the perfect cocktail is a science: It takes precision and know-how to get the desired result. This is your textbook. Author Dave Arnold draws on years of experimentation to explain everything from the basics of blending flavors to the joys of nitro-muddling. His 120 recipes will turn you into the mixologist you've always wanted to be.

CONSERVE THE COLD THROUGH THE MAGIC OF EVAPORATION.





Hit the Spot

FREDERICKS & MAE DARTS AND DARTBOARD **$132, $140**

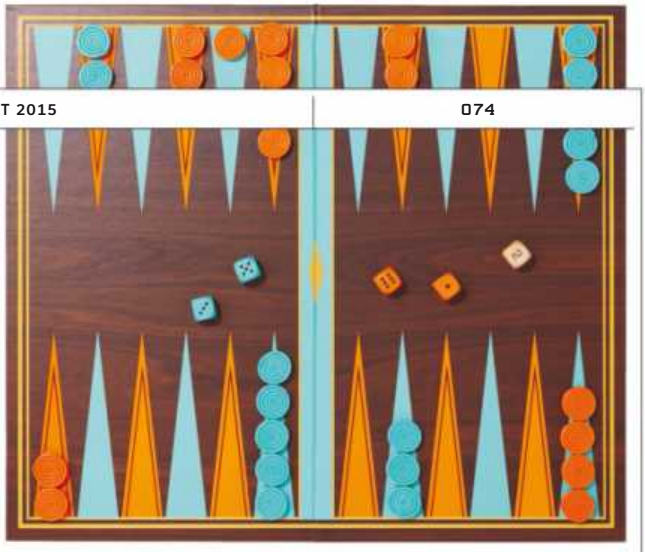
Darts were once tools of war, weighted at the tips so their points would drive into human targets. Ouch. Today they're rarely used as weapons. They're also rarely this pretty. Fredericks & Mae's thread-wrapped instruments of fun come in sets of three and match its boldly colored dartboard. The target looks like something you'd see in a gallery of early-20th-century art, not a dive bar. You can fling darts at it or just hang it up and stare. There's no shame in this game.

PERFECTLY CHILL

MAGISSO NATURALLY COOLING ICE BUCKET AND CARAFE **$90, $65**

This line of terra-cotta barware uses an ancient trick: Briefly soak a ceramic vessel in water before filling and it'll keep the contents cold for hours, as moisture evaporates from its porous walls. Created for the Finnish company Magisso by ceramic designer Simon Stevens, this carafe and matching ice bucket are delightfully low tech and high style.


Haiti/Frederic Sautereau
WHERE THERE ARE
NO HOSPITALS
THAT'S WHERE WE OPERATE.
MEDECINS SANS FRONTIERES
DOCTORS WITHOUT BORDERS
DoctorsWithoutBorders.org



VISTA POINTS

WILD & WOLF
BACKGAMMON SET **$23**

Rolling an acey-deucey with orange and turquoise dice probably won't be any more satisfying, but you may finally convince your Miami Dolphins–loving friend to play backgammon with you.



MAIN SQUEEZE

BREVILLE CITRUS
PRESS **$200**

Margaritas made with fresh-squeezed lemons and limes? Oh, yeah. But the juice part can be a chore. This hardworking, drip-free citrus press lets you crank out pitchers of the stuff without the mess. The handle distributes pressure evenly for maximum juice, and the quiet motor won't disrupt your guests' witty chatter.

UNCHAINED MELODIES

Wireless speakers give you more flexibility for enjoying your jams. Home models let you pick songs from the couch; mobile options turn your picnic into an EDM festival.



The Wanderer

UE BOOM 2 **$199**

Portable Bluetooth speakers are known for their convenience, not their sound. The UE Boom 2 upends that assumption. This sequel to a thumping, battery-sipping, cylindrical blaster that was already one of our favorites adds wireless range, ruggedness, and waterproofing for poolside plays. Another fun new trick? Just tap the top to pause, play, or skip.

The House Band

SONOS PLAY:5 **$499**

The best option for filling your home with high-quality wireless audio is Sonos. Put the newly redesigned Play:5 speaker in your spacious parlor with the vaulted ceilings and let it bring the noise. Plus, when you set up the device, it automatically tunes itself to the space—you'll get the crispiest sound in any room of the house.





The Hammer of the Gods

BOWERS & WILKINS ZEPPELIN WIRELESS **$699**

With the addition of Bluetooth and Spotify Connect, B&W's iconic home speaker is no longer AirPlay-only. (It's also no longer an iPhone dock.) The rest of the guts have been reengineered to bring even greater clarity and punishing volume to those Led Zeppelin remasters. Sure, it looks like a giant doobie, but it sounds super dope.

HUAWEI

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AND CUTTING-EDGE
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CREATE

Your left brain is sore from nailing down those 2016 budgets. So let your right brain run the show for a while. Choose your instrument—a guitar, a camera, a pencil—and unleash your imagination.



Number One No. 2s

RHODIA PENCILS **$9 FOR 3**

Where'd that damn pencil go? Probably rolled off the table again. Don't risk a back sprain trying to reach for it; buy a set of these scribblers instead. The triangular shape keeps them where you left them, and the black linden-wood innards look plain gorgeous.

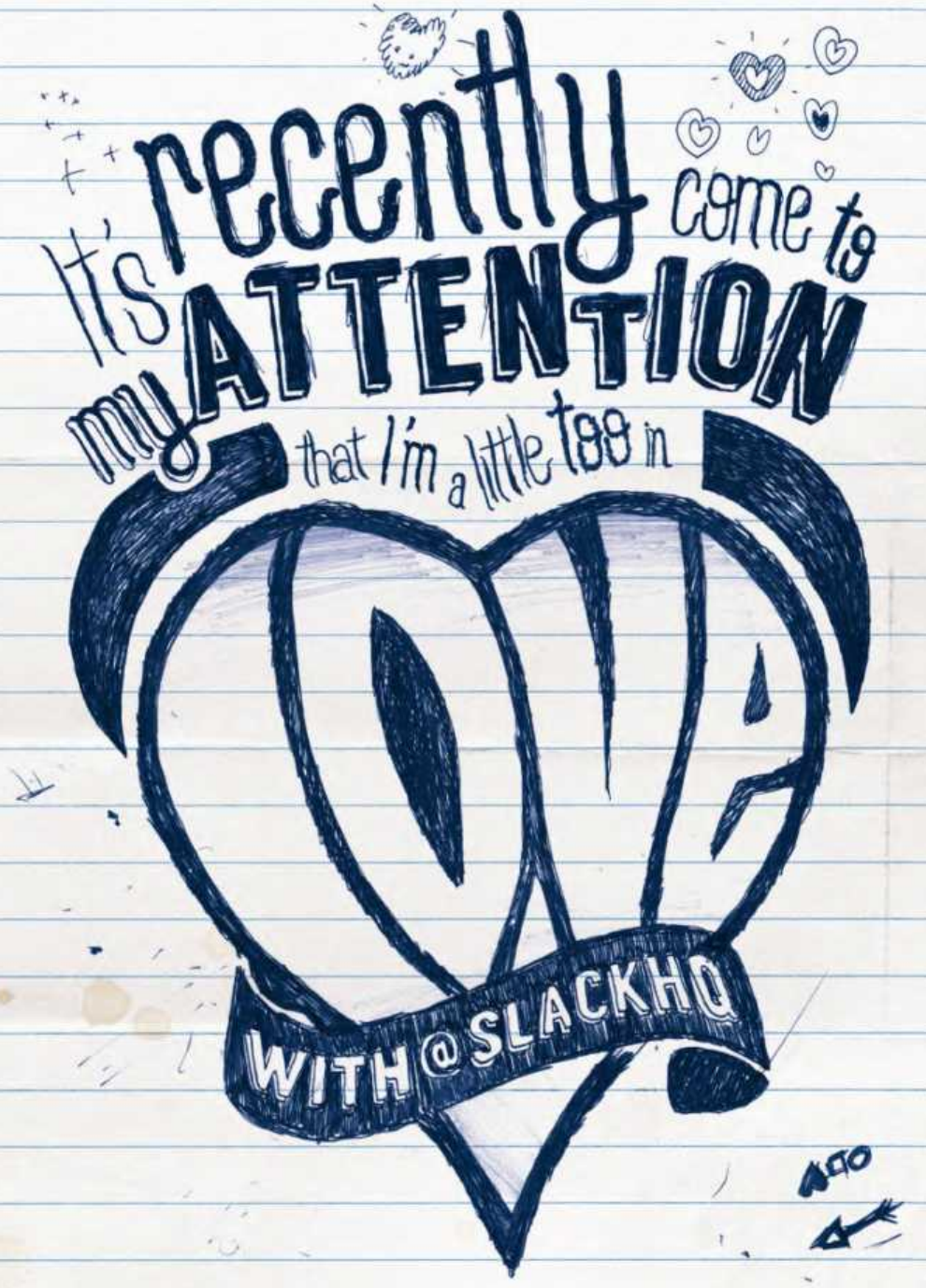


BLOCK PARTY

BLOCKITECTURE
HABITAT **$25**

Any average toddler can stack blocks. Cantilevering, on the other hand, that's the kind of thing more advanced children—your children, for example—might do. Hand your prodigies this set of specially notched blocks and let them dream up buildings as unconventional as Moshe Safdie's Habitat 67.

SKETCHBOOK	**$4**
PENCILS	**$9**
BUILDING BLOCKS	**$25**
STYLUS	**$50**
POCKET SYNTHESIZER	**$59**
HAMMER	**$79**
SMARTPHONE LENS SET	**$99**
IPHONE CAMERA	**$599**
3-D PRINTER	**$2,899**
SONY DSLR	**$3,000**
ELECTRIC GUITAR	**$5,250**
LEICA CAMERA	**$7,450**



We're blushing, **@RonnellSmith**. Thank you.

We like to think Slack's changing the way teams communicate. But don't take our word for it.
slack.com/love

slack
Work on purpose

NAILED IT!

HARDCORE HAMMERS
THE ORIGINAL **$79**

THE CURVED HICKORY HANDLE ON THIS DOUBLE-DUTY BEAUTY SHOWS HOW ELEGANT ONE OF HUMANKIND'S OLDEST TOOLS CAN BE. THE HEAD'S RECESSED GRIPPY SURFACE LETS YOU USE IT AS A FRAMING HAMMER, WHILE THE OUTER RIM ELIMINATES THE NEED FOR A DELICATE FINISH HAMMER TO COMPLETE THE JOB.
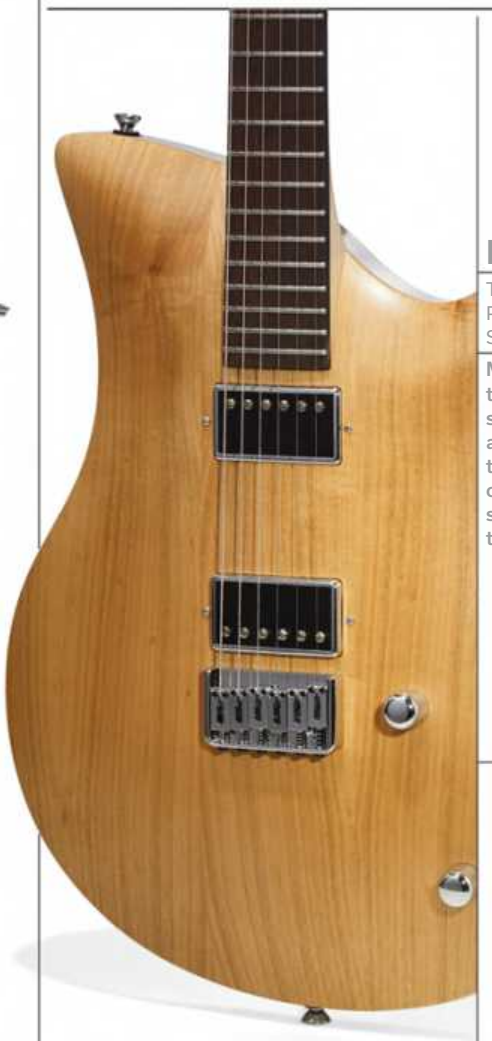




Ready, Set, Build

MAKERBOT REPLICATOR
DESKTOP 3-D PRINTER **$2,899**

It's not as high-powered as the *Star Trek* replicators, but this tabletop 3-D printer has a clever, easy-to-grok UI. Its 100-micron-layer resolution affords stunningly precise prints too. The plastic filament it uses to create objects comes in dozens of colors and types, including composites that mimic the feel of stone and iron.



Light Touch

RELISH JANE GUITAR **$5,250**

One not-so-electric thing about playing an electric guitar: toggling the three-way pickup switch. Relish nixes the switch with hassle-free LED touch sensors on its forward-thinking, Swiss-crafted instrument. Available in ash, cherry, and walnut, it's sleeker and sexier than you're used to, so maybe don't smash it to pieces at the end of the first set.

Marching Band

TEENAGE ENGINEERING
POCKET OPERATOR
SYNTHESIZERS **$59 EACH**

Musicians walk to the beat of their own drum. These pocket-sized synths let them create electronic symphonies as they strut. Each of the three options—melody maker, bass synth, and drum machine—features an LCD control screen.





WRITE AWAY

FIFTYTHREE PENCIL **$50**

This was the original Pencil, and even Apple's new iPad Pro–only stylus can't measure up to FiftyThree's writing implement—it works with the iPhone, the iPad, and a number of iOS apps. Broad and comfortable, it may even make your chicken scratch look more like calligraphy. Keep one in your bag for the times when you can't quite turn that idea into words.



Aw, thanks **@bamadesigner**, we like you too.

We like to think Slack's changing the way that teams communicate. But don't take our word for it.
slack.com/love

slack
Work on purpose



THINK PADS

FABRIANO ECOQUA NOTEBOOK **$4 AND UP**

Time to upgrade your sketchbook. Fabriano's colorful and elegant notebooks promote guilt-free writing and doodling, thanks to their environmentally friendly papers and inks. Choose from eight colors, or buy them all and fill every page with the contents of your brain.

PHOTO OPS

Enthusiasts love their big rigs, and artists can't live without their specialty shooters. The rest of us are devoted to our mobiles. Meet our new favorite cameras.

The Cartier-Bresson

LEICA M MONOCHROM 2 (TYPE 246)
$7,450 (BODY ONLY)

In the song "Kodachrome," Paul Simon sings that everything looks worse in black and white. Not so, Mr. Simon—the black-and-white-only M Monochrom takes stunning pictures, and Leica says the 24-megapixel full-frame sensor in this updated model captures more light, detail, and sharpness than many color shooters out there.





The Stick-Ons

PHOTOJOJO LENS SET **$99**

Your smartphone's camera is already pretty damn good. Make it even better with Photojojo's set of add-on lenses. Each of the five aluminum-and-glass lenses fastens to Apple and Android phones via magnets, and they even work with many popular cases. Instagram filters will look like amateur hour compared to the results from these.

The iPhone Power-Up

DXO ONE **$599**

This little lensman snaps into your iPhone's Lightning port. Paired with its app, the One takes over photo duties from the phone's built-in shooter, giving you a higher-quality system that matches the capabilities of an honest-to-goodness point-and-shoot camera—a light-slurping f/1.8 lens and 20.2 megapixels of image-capture goodness.

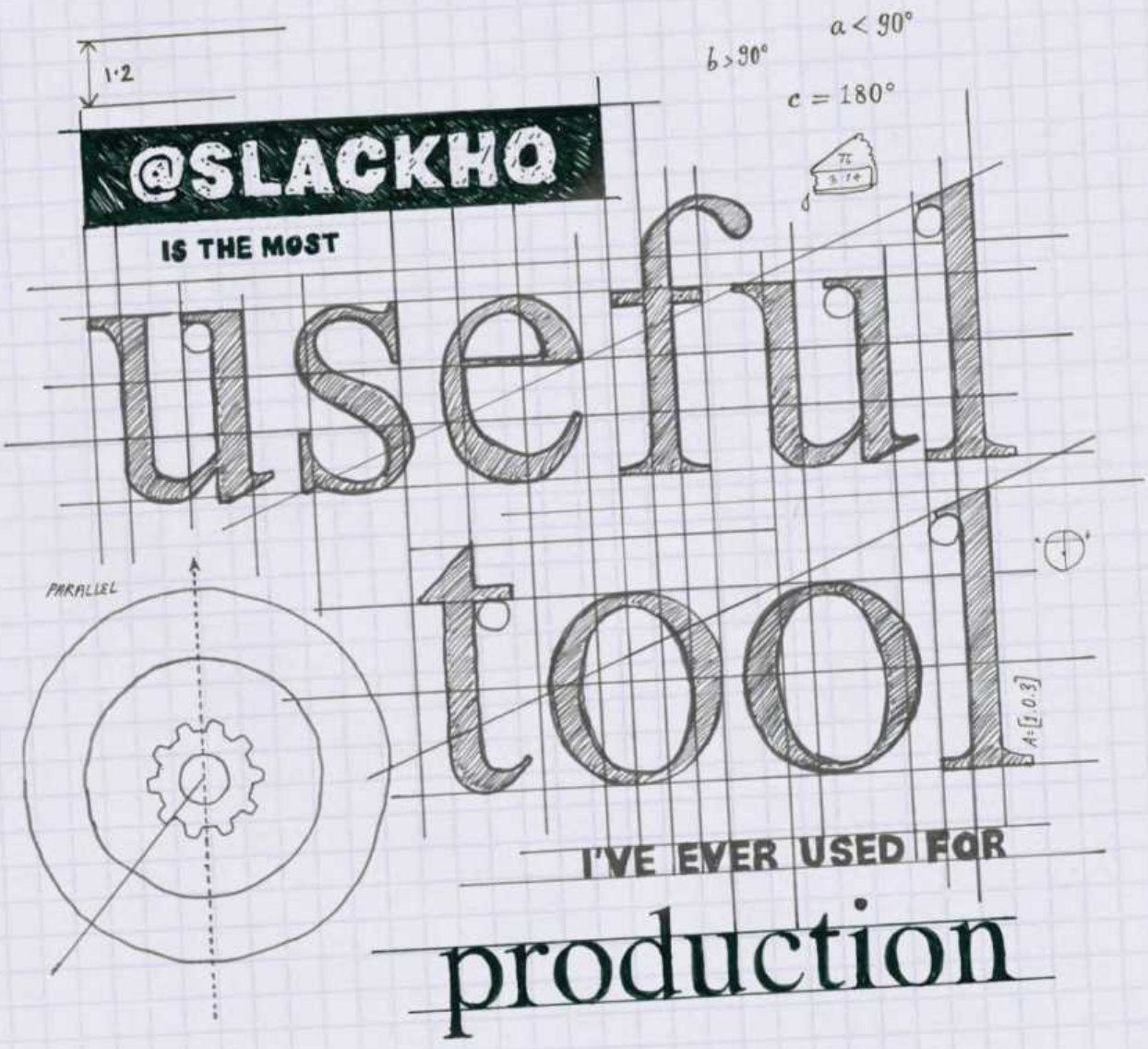




The Professional

SONY A7S II **$3,000**

If you're shopping for a pro-quality DSLR, Sony's flagship is one of the hottest buys this season. Its 12.4-megapixel full-frame sensor focuses fast, shoots 4K video, and practically sees in the dark (ISO extends to 409,600). A five-axis stabilization system keeps everything steady. Attach any of Sony's E-mount lenses, or use an adapter to deploy your preferred vintage glass.



Thanks, **@AshleySamour.** Here's to being useful together.

We like to think Slack's changing the way that teams communicate. But don't take our word for it.
slack.com/love

slack
Work on purpose

MOVE

Whether you're paddling to catch the perfect wave, summiting a snow-covered mountain, or running in pursuit of the four-minute mile, you always push yourself to the limit. This gear will take you as far as you want to go, and maybe even farther.



Hot Wheels

BUDNITZ NO.1 SCORCHER TITANIUM **$6,440**

The disc brakes and maintenance-free carbon belt drive on this city bike make it great for commuting, but Budnitz's murdered-out Scorcher isn't ready to hang it up at quittin' time. The burly titanium frame and knobby Schwalbe tires are just as capable at shredding singletrack as they are cruising the bike lane. Plus, with that matte-black paint job and inverted handlebars, it just looks *mean*.



SLAM DUNK

SPALDING ABA BASKETBALL **$126**

You can't go as hard in the paint as you used to. But with a piece of hoops history, you can still school opponents on the court. Turn back the shot clock to the early '70s and the glory days of the American Basketball Association with the league's iconic red-white-and-blue ball.

LANTERN/BATTERY	**$100**
BASKETBALL	**$126**
RUNNING SHOE	**$130**
INSULATED VEST	**$199**
FITBIT WATCH	**$250**
MICROSOFT BAND	**$250**
HIKING BOOT	**$320**
WITHINGS WEARABLE	**$450**
GARMIN WATCH	**$500**
ECOBOARD	**$775**
FOLDING KAYAK	**$1,975**
TITANIUM BIKE	**$6,440**



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Crafted as a Holiday Gift.

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SPRING IN YOUR STEP

ON CLOUDRACER SHOE **$130**

THE CLOUD: A WELCOMING PLACE FOR YOUR DATA—AND YOUR FEET. THE TREADS ON THESE RUNNERS ARE MADE OF PUFFY, SPRING-LIKE NUBS THAT PROVIDE A SOFT LANDING AND A PROPULSIVE FORWARD STEP. COMBINE THE INVENTIVE LOOK WITH A LIGHT-WEIGHT AND TREND-BUCKING SVELTE BUILD, AND THIS SHOE IS UNBEATABLE.



ACTION HEROES

All these wearables track your physical activity in similar ways, but each approaches the task with its own sense of style.

The Runner

FITBIT SURGE FITNESS SUPER WATCH **$250**

This waterproof sports wearable logs your physical activity (heart rate, distance, steps, sleep) and uses GPS to track your jogging routes. While you're putting in the miles, it shows phone notifications and controls your music. It's on the large side, but with a solid week of battery life, you'll run out of energy before it does.





The Triathlete

GARMIN FĒNIX 3 **$500 AND UP**

Serious, stylish athletes may have finally found their match. This activity-tracking watch connects to your various sensors and devices via ANT+, Bluetooth, or Wi-Fi. And since Garmin made its bones in GPS tech, the Fēnix 3 can track your runs, rides, and swims (yep, it's water*proof*).

The Hybrid

WITHINGS ACTIVITÉ **$450**

Who says a fitness tracker needs to look like a chunky future-bracelet? Or that a fancy watch should only tell time? The Withings Activité manages to hide a robust array of sensors inside a water-resistant timepiece that feels as natural on your wrist as a pair of 18-karat cuff links.





The Coach

MICROSOFT BAND **$250**

Redmond's updated bracelet goes way beyond step counting. When you wear a Band, it can track your heart rate, sleep, and all different sorts of exercise. It'll even guide you through sets and reps, counting them with you. When you're finished, ask Cortana how to get to the juice bar.

SOUND THINKING

In an age of sonic overload, "hearables" are the latest class of wearables, offering remarkable innovations that will be more than music to many ears.

HEARING BY NUMBERS

Exposure to noise ***80 decibels*** or higher (***rock concerts = 120 dB***) for more than 15 minutes per day can cause long-term hearing loss.

Everyday sounds, such as a lawn mower or truck traffic, average ***90 decibels.***

1 in 10 Americans is affected by impaired hearing; ***60***% of them are below retirement age.





STARKEY HALO™

This breakthrough hearing device works with the TruLink™ Hearing Control app and Bluetooth® to stream calls, music, and Siri right into your ear. Smart, adaptive features mean there's no need to take it off for in-person conversations or fiddle with tiny, in-ear controls. Halo's innovative technology allows for remote system fine-tuning through clear on-screen controls. A memory function with geotagging enables settings and auto-activations for 20 environments, and an adaptive car mode also adjusts automatically.

HAVE YOU HEARD?

Designed specifically for Starkey Halo™ hearing devices, the TruLink Hearing Control app is engineered to work specifically with your iPhone®, iPad®, iPod touch® and Apple Watch® and select Android™ phones.

Download on the App Store

ANDROID APP ON Google play

TUNE IN...

To your own hearing. If you haven't had a hearing test this year, take one now. You might not know what you're missing. With the technology now at hand, you don't need to miss a beat...or a whisper. Learn more at starkey.com/online-hearing-test

"Made for iPod," "Made for iPhone," and "Made for iPad" mean that an electronic accessory has been designed to connect specifically to iPod, iPhone, or iPad, respectively, and has been certified by the developer to meet Apple performance standards. Apple is not responsible for the operation of this device or its compliance with safety and regulatory standards. Please note that the use of this accessory with iPod, iPhone, iPad or Apple Watch may affect wireless performance. Apple, the Apple logo, iPhone, iPad, iPod touch, and Apple Watch are trademarks of Apple Inc., registered in the U.S. and other countries. App Store is a service mark of Apple Inc. Halo and TruLink are compatible with iPhone 6s Plus, iPhone 6s, iPhone 6 Plus, iPhone 6, iPhone 5s, iPhone 5c, iPhone 5, iPhone 4s, iPad Air 2, iPad Air, iPad (4th generation), iPad mini 3, iPad mini with Retina display, iPad mini, iPod touch (5th generation) and Apple Watch. Use of Apple Watch requires iPhone 5 or later.

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Starkey Hearing Foundation conducts hearing missions in the United States and around the globe to bring the gift of hearing and empower those in need. Annually, the Foundation provides more than 200,000 hearing aids, and has committed to providing 1 million more by the year 2020, so the world may hear.

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PROMOTION

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FEATURING

Beats by Dr. Dre

Huawei

John Varvatos

Piquadro

Sennheiser

Sony

Speck

Tote Your Boat

ORU COAST KAYAK **$1,975**

A kayaking trip can entail some serious logistics, but this 16-foot vessel makes them easy. It folds into a lightweight box you can check at the airport or store in your closet. When you reach the river, five minutes of reverse origami will have you on the water.





TRAILBLAZERS

ARC'TERYX BORA² MID GTX HIKING BOOT **$320**

WEAR THESE BOOTS IN THE MUD, ON THE MOUNTAIN, OR IN THE SNOW—JUST SWAP IN THE APPROPRIATE LINERS. THE OUTSIDE CAN STAND UP TO ANY TERRAIN AND WEATHER, WHILE THE LINERS MOLD COMFORTABLY TO YOUR FEET.



Green Splash

LOST PUDDLE JUMPER ECOBOARD **$775 AND UP**

Surfers love the ocean, but the foams and resins in their boards are toxic. Thanks to new industry standards outlined by Sustainable Surf, you can order boards from top shapers made with environmentally friendly materials. Try a bamboo deck, recycled foam, or bioresin. This one was custom-made for Third Eye Blind's Stephan Jenkins.



LITE BRITE

BIOLITE NANOGRID **$100**

This combination lantern and battery pack has a USB output and two detachable lights in addition to the main lamp (shown). Use it to illuminate your food prep site, your stove, and your tent—all while juicing up your iPhone.



Good Investment

PATAGONIA NANO-AIR VEST **$199**

Vests are for adventurers—just ask Han Solo and Marty McFly. This cozy, rip-resistant version will keep you toasty and protected. It's warm and breathable, making it the perfect companion for early morning trail runs, lakeside yoga, or a quick trip to Tatooine.

STAR WARS™

STANCE



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MAKE TECH HUMAN

THERE'S NO TIME LIKE THE PRESENT TO SHAPE THE FUTURE.

For the past nine months, Nokia and WIRED have been asking some of the greatest minds on the planet (including yours) what excites and worries them about where technology is taking us (or vice versa) and how we can shape that in a more human direction. And while this conversation raises as many questions as it answers, it's clear that the time to start talking about it is now.



"The real risk with A.I. isn't malice but competence. A superintelligent A.I. will be extremely good at accomplishing its goals, and if those goals aren't aligned with ours, we're in trouble."

STEPHEN HAWKING
THE STEPHEN HAWKING FOUNDATION



"While the Internet has made us a more globally connected society, it can also disconnect us from humanity—our own and seeing it in others."

MONICA LEWINSKY
BYSTANDER REVOLUTION



"I am concerned about losing our ability to experiment, disrupt the status quo, innovate, and rebel."

HOSSEIN MOIIN
NOKIA NETWORKS

POLLS:

Technology provides more people with access and opportunity. It also eliminates jobs and widens the wealth gap.

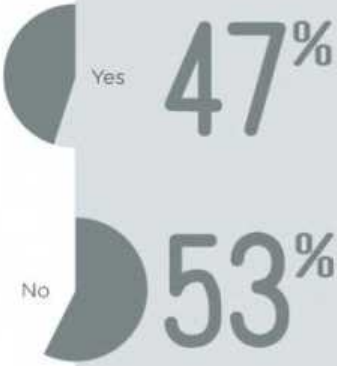
82%

say its benefits outweigh the downsides

39%

believe unlimited connectivity exaggerates differences instead of bridging the gap

Is privacy a thing of the past?



Monica Lewinsky Photo: James Duncan Davidson/TED

MEET THE #MAKETECHHUMAN 2015 AGENTS OF CHANGE

17 INFLUENCERS, ENTREPRENEURS, AND ACTIVISTS EXPANDING HUMAN POSSIBILITY THROUGH TECHNOLOGY



"The Web is not just a luxury, it is critical for people to really take part in society and education."

SIR TIM BERNERS-LEE
WORLD WIDE WEB FOUNDATION



"We need to inject humanism into our A.I. education and research by injecting all walks of life into the process."

FEI-FEI LI
STANFORD UNIVERSITY

NOTABLE COMMENTS

TED Talks
@TEDTalks

"Technology needs to be programmed with human values." What are those universal human values? Do they exist? #maketechhuman #TED2015

AGENT OF CHANGE
Chris Valasek
@nudehaberdasher

"Secret is out. @0xcharlie and I are human. #maketechhuman

On Reddit
reddit.com

"Am I the only one who thinks it's going to take a lot of work to get us from our current situation (basically surrounded by mid-20th-century technologies plus some devices) to a future that actually resembles a future? Going from smart phones to smart buildings etc will be monumental, in my opinion."

CHECK OUT THE EBOOK

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OBSESS

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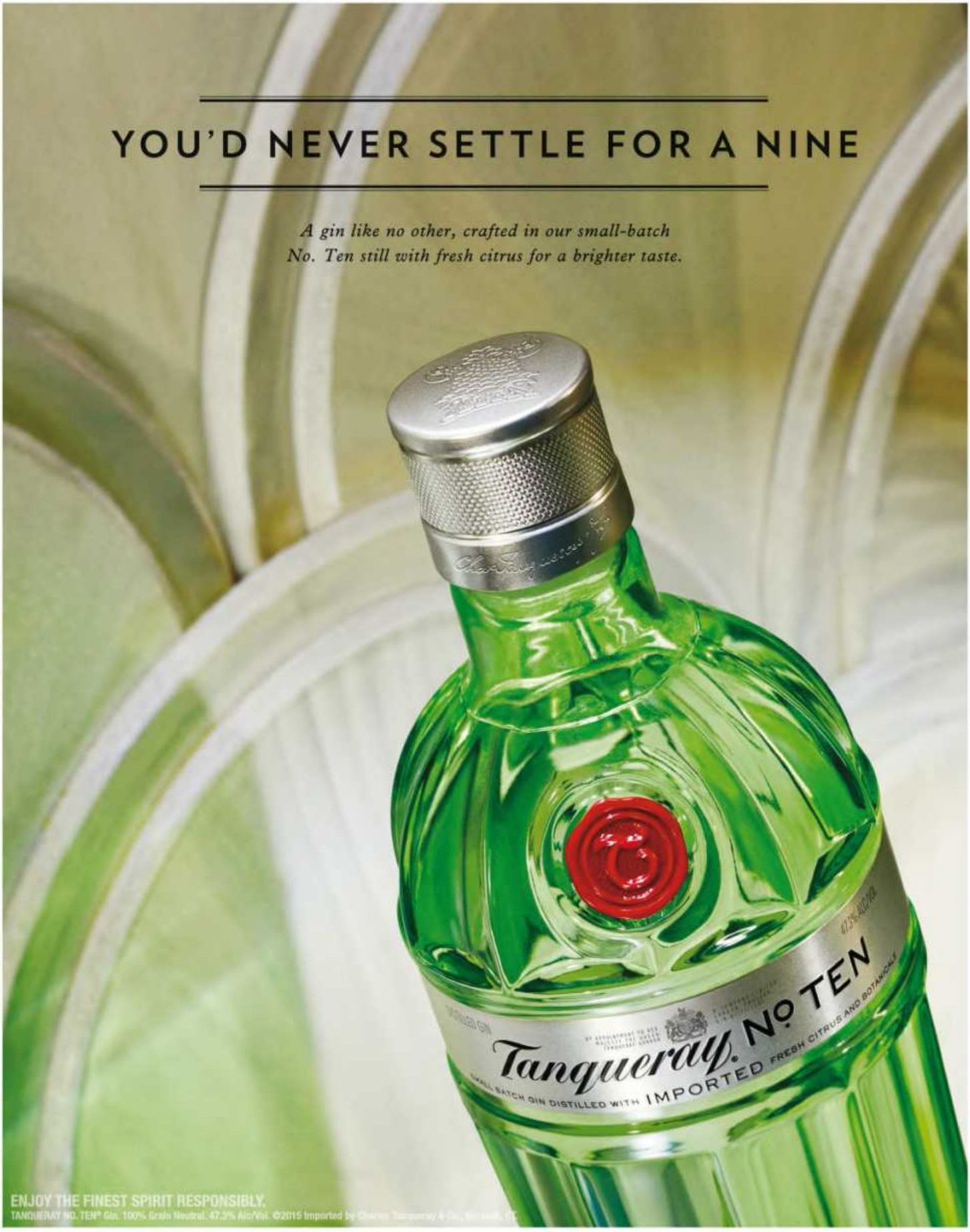


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This isn't your grandmother's cast-iron pan, unless Grammy ran her own metal-casting workshop. Borough Furnace's handcrafted skillet is made from recycled iron and arrives preseasoned with flax oil. The slanted sides make it easy to slip a spatula under Nonna's meat loaf.

ROBOT NUTCRACKER	$30
PARROT DRONE	$99
GARDEN SENSOR	$100
TETRIS CUSHIONS	$100
BIONIC BIRD	$135
STAR WARS DROID	$150
GAMING CONTROLLER	$300
BRAISING SKILLET	$320
GEOMETRIC CHAIR	$4,980
AUTOMATIC WATCH	$5,450



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Stake, Well Done

EDYN GARDEN SENSOR **$100**

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PERFECT TIMING

TAG HEUER CARRERA CALIBRE 18 **$5,450**

Here's a watch you don't need to recharge every night—the automatic movement winds it as you wear it. The sapphire-topped, polished-steel 39-mm case houses a dual-dial chronograph that's designed to be read easily at a glance. The Carrera is made for driving and is named for the famed Carrera Panamericana auto race. It's the perfect timepiece to strap on when you take your Alfa Romeo out on the twisties.

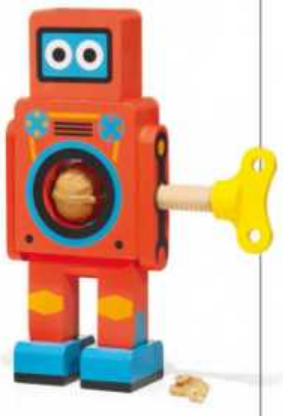
WEAR YOUR PASSIONS ON YOUR SLEEVE—OR IN THIS CASE, YOUR WRIST.



Hot Seat

DOUBLE ZERO CHAIR FOR MOROSO **$4,980**

David Adjaye, architect of the Smithsonian's National Museum of African-American History and Culture in Washington, DC, crafted this geometric chair out of little more than a pretzeled gold frame and two circular cushions. The sum, however, is way more than its parts: The Double Zero seater is a modern expression of 1970s art deco cool.



Crack Bot

ROBOT NUT CRACKER **$30**

Anthropomorphic nutcrackers, once guarding only holiday tabletop displays, can now be a perennial cocktail-party fixture. This Pixar-sweet version harks back to the tin-toy windup robots that came out of Japan in the 1950s and '60s. It pairs well with walnuts and old-fashioneds.

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Soft Wares

TETRIS 3-D CUSHIONS **$100**

Long before *Candy Crush* existed, Tetris taught us what it was like to surrender all free time to a game. The digital tile puzzler has transcended the screen and entered the third dimension in the form of plush cushions. Like the real thing, the pillows are endlessly reconfigurable. Unlike the real thing, they'll keep you off your toes, not on them.

SMOKIN' BOTS

First, robots were menacing. Then they were helpful. Now they're just fun. Whip out your smartphone to bring these drones to life.



THE ROLLER

BB-8 DROID BY SPHERO **$150**

THE FIRST TIME YOU SAW THIS DROID IN THE NEW *STAR WARS* TRAILER, YOU PROBABLY THOUGHT IT WAS COOL BUT PHYSICALLY IMPOSSIBLE. WELL, HERE'S PROOF IT WORKS. THIS APP-CONTROLLED BOT IS A FULLY SHRUNK-DOWN VERSION OF THE ONSCREEN STAR—THE PERFECT PLAYTHING TO KEEP YOU OCCUPIED UNTIL *THE FORCE AWAKENS* HITS THEATERS.



The Copter

PARROT AIRBORNE CARGO DRONE **$99**

Not all flying drones are $1,000 behemoths. Parrot's tiny Airborne Cargo flier is small enough to fit in your hand. Piloting is remarkably easy: The copter automatically takes off or lands with a single tap of the smartphone app. The Lego-compliant top lets you take your mini-fig for a spin. The Parrot shoots video too—just don't try for a close-up of the cat. (We learned the hard way.)



THE FLAPPER

BIONIC BIRD **$135**

Your parents played with paper gliders. You played with a windup bird with flapping mechanical wings. Your kids can have the Bionic Bird: a Bluetooth-connected drone dressed up as an avian creature. The 9-gram barnstormer goes where your smartphone tells it to and can soar for up to 300 feet.

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GLASS CARAFE	**$100**
MODULAR HEADPHONES	**$145**
ALARM CLOCK/LIGHT	**$190**
HAMMOCK	**$195**
EARBUDS	**$199**
TABLE LAMP	**$350**
WIRELESS HEADPHONES	**$500**
LOUNGE CHAIR	**$900**
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Ace Pitcher

KARTIO CARAFE **$100**

Recharging your body involves more than just getting enough rest—it also means topping up your fluids. This 24-ounce glass carafe is dishwasher-safe, and the pinch in the middle provides a sure grip. By the way, it's time for another glass of water. (Tumblers sold separately.)





Great Awakenings

WITHINGS AURA **$190**

This alarm clock/lamp hybrid greets you every morning with an electronic sunrise—the light inside gradually increases in intensity as the inevitable hour approaches. A speaker in the base can rouse you with a Spotify playlist or lull you to sleep with a soothing dose of NPR. An optional sleep-tracking pad ($130) slips under your mattress and monitors your slumbering habits.



Touch Wood

BANG & OLUFSEN BEOSOUND MOMENT **$3,295**

B&O's new wireless music system pulls all your tunes into one awesomely simple interface. To play, tap the touch-sensitive oak panel. (Whoa.) Scroll to adjust volume. Feeling blue? Flip it over and tap the color wheel on the display to change the mood—closer to the center for old favorites, farther out when you want to get freaky. Brilliant.

YOUR DOWNTIME IS WHEN YOUR BEST IDEAS COME TO LIGHT.



AT EASE

DOT & BO SIMPLE SURPRISE LOUNGE CHAIR **$900**

A comfortable lounge chair doesn't need to dominate the room with bloated La-Z-Boy dimensions. The Surprise combines perfectly contoured arms and legs of solid ash with just the right amount of plush cushioning. The result? A throne that's game for hours of chilling.

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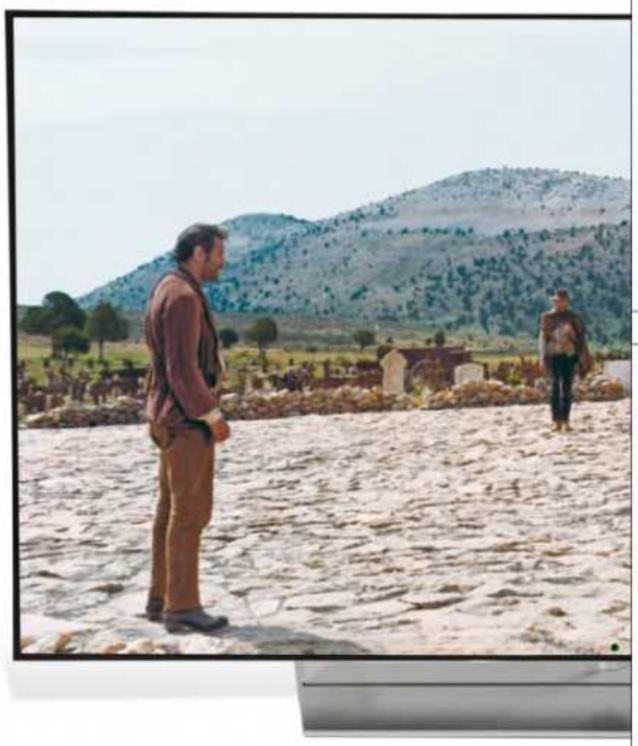


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LG 65-INCH CLASS OLED 4K SMART TV **$5,000**

Do you want the ultimate combination of razor-sharp resolution, mind-boggling contrast, and sheer sexiness? Look no further than LG's wafer-thin 65EF9500, which is the best television we've ever seen. Clint Eastwood's squint never looked so gloriously intimidating.

Ball Lighting

BULB: BRASS **$350**

The death of the Edison bulb was a boon for the environment but a point of sorrow for decorators. Now you can have both energy-efficiency and aesthetics with this starkly minimalist table lamp—its translucent globe hides a CFL inside. It does away with a traditional stand, depending instead on the caplike base to support the hand-blown opal glass shade.





THE CLEAR CHOICE

CB2 BETTY GLASS TEAPOT **$20**

YOUR AFTERNOON OOLONG IS MISSING SOMETHING. NOT MILK—A BEAUTIFUL PRESENTATION. THIS TEAPOT IS MADE OF BOROSILICATE GLASS—THE STUFF OF LAB BEAKERS—SO YOU CAN POUR HOT WATER RIGHT INTO IT WITHOUT WORRY. THE BEST PART OF ALL? WATCHING IT STEEP. AHH ...





Cloud Source

GOOGLE CHROMECAST **$35**

There are plenty of ways to stream content to your TV, but it's hard to find a cheaper, more well-rounded (and, well, rounder) method than Google's latest Chromecast. The dongle whisks whatever's on your phone to your big screen. New discovery features mean you're never more than a tap or two away from something worth watching.

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HANG TWO

UNCOMMONGOODS
DO GOOD HAMMOCK **$195**

The only thing better than a hammock for you is a hammock for two. Handwoven by members of the Mlabri people in northern Thailand, this extrawide hanging retreat is made out of 3 miles of yarn and can hold up to 400 pounds.





Not a Replica

SQUARE DOUBLE OLD-FASHIONED GLASS **$75**

Throughout *Blade Runner*, protagonist Rick Deckard (Harrison Ford) sips whiskey from a sculptural glass with an unusual taper in the middle. The drinkware isn't just a prop; the same Italian manufacturer is still producing the hand-blown Cibi crystal tumblers, based on a 1972 design by architect Cini Boeri.

HEAD SPACES

Like to blast tunes on the commute? Want to drown out the buzz in the office? Here are three sets of headphones to meet your audio needs.

The In-Ears

MASTER & DYNAMIC
ME05 **$199**

Ditch your tinny EarPods for something with more class. These earphones place a premium on design, right down to the solid brass housings and tangle-free cable. They're also crazy comfy in your hear-holes. And since they come from Master & Dynamic, they have the same powerful, crisp sound as the company's much-loved over-ears.





The Unleashed

SENNHEISER MOMENTUM
WIRELESS **$500**

One of our favorite over-ear headsets from the venerable German brand is now cable-free, and it's better for it. These cans have a 22-hour battery, can connect to any Bluetooth device, and sport some impressive active noise-canceling tech. Plus, the luxe materials are matched by sumptuous sound.

The Custom

AIAIAI TMA-2 MODULAR
HEADPHONES **$145 AND UP**

These Swedish headphones are modular, letting you build your ideal audio experience. Choose from over-ear or on-ear pads, speakers tuned for different music, three headbands, coiled or straight cords—360 possible combos in all—and pop 'em together like hi-fi Legos.



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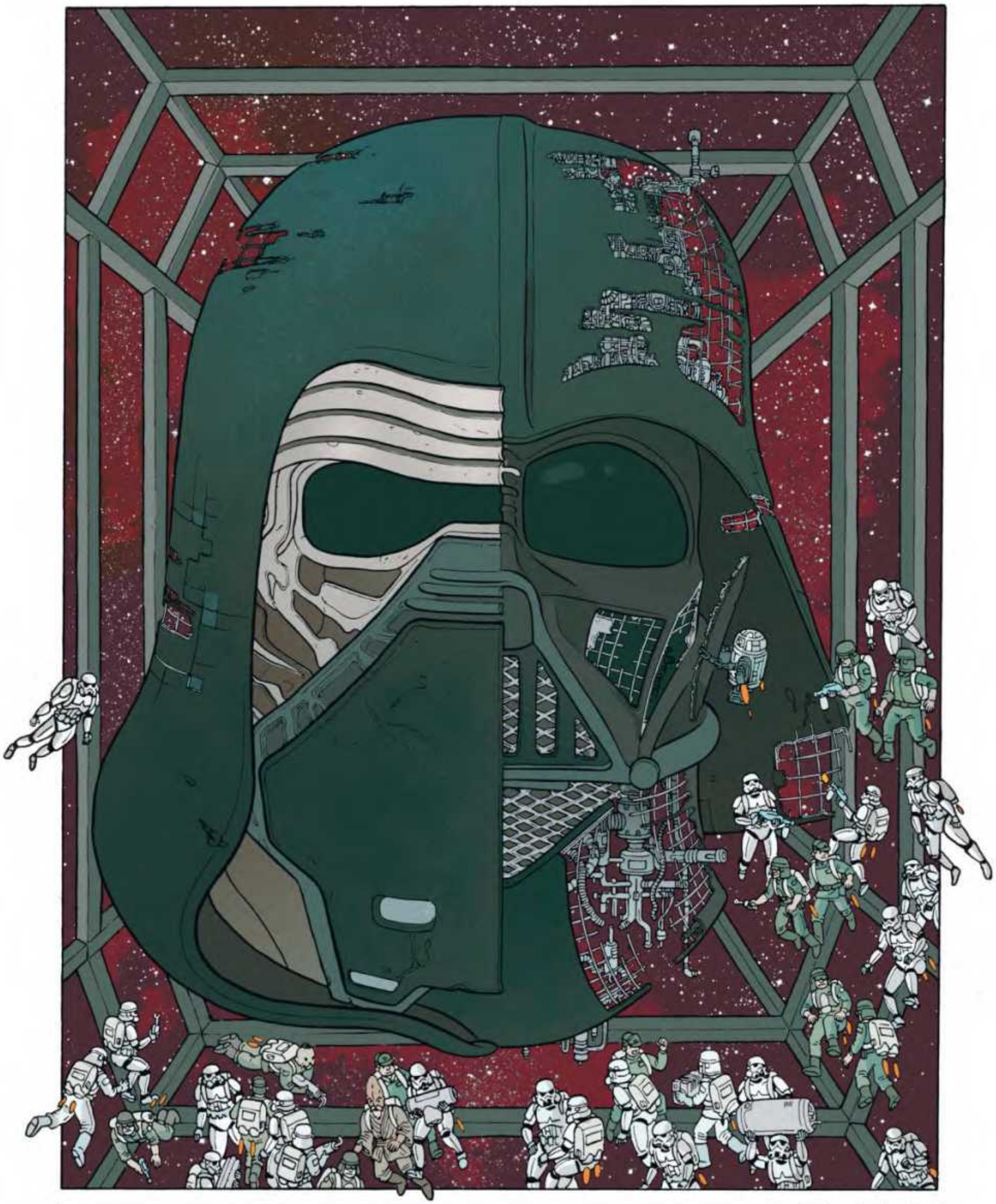
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ULISES FARINAS



HOW J.J. ABRAMS WENT FROM AWESTRUCK SUPERFAN TO JEDI MASTER IN HIS QUEST TO CREATE *STAR WARS. THE FORCE AWAKENS.*

LUCKY VII

AN INTERVIEW BY **SCOTT DADICH**



DAN WINTERS



PREVIOUS SPREAD: GROOMING BY LOUISE MOON FOR BUMBLE AND BUMBLE; ALL *FORCE AWAKENS* STILLS: ©LUCASFILM 2015

STEP THROUGH THE sleek, anonymous metal door of J.J. Abrams' Bad Robot Productions and you enter a world of memorabilia—the murderous Talky Tina doll from *The Twilight Zone,* rows of VHS tapes labeled "Midnight Movies," a *Six Million Dollar Man* board game, assorted Godzillas. But look closely and you will see a meticulousness to the madness: The props and tchotchkes are all dust-free and carefully arranged. Those 1970s *Star Trek* action figures aren't just sitting there. They're *posed*. It's clear that in addition to being one of the most gifted movie directors in the world, Abrams is also a superfan.

That puts him in a precarious situation. He has inherited the one mega-franchise to rule them all. And this is no reboot. Abrams is marshaling the same actors, writers, designers, and even the same composer to reanimate the characters and themes that made the original *Star Wars* into, well, *Star Wars*. He loves those movies as much as you do. But when he first met those movies he was just an apprentice. Now he must become the master.

No pressure, right? After all, the stakes are merely the future of the franchise that made Abrams a filmmaker; a mythology held precious by millions; and, oh, right, billions and billions of dollars in movies and merch. I sat down with Abrams to ask him about balancing these competing (ahem) forces. The lightsabers are drawn. The coordinates for the jump to hyperspace are calculated. Can Abrams do it? Well, you know what Yoda said about merely trying.



WIRED — How are you feeling? It seems like only yesterday you were announced as the director of *Episode VII*.

J.J. ABRAMS — Good! It's a crazy thing, right? I can't wait for people to see the movie. We've been baking this cake for a long time, and now it's time to serve it.

W — How much of *The Force Awakens* is geared toward welcoming people back to the *Star Wars* franchise versus starting something completely new? How do you strike a balance between those two imperatives?

A — We wanted to tell a story that had its own self-contained beginning, middle, and end but at the same time, like *A New Hope*, implied a history that preceded it and also hinted at a future to follow. When *Star Wars* first came out, it was a film that both allowed the audience to understand a new story but also to infer all sorts of exciting things that might be. In that first movie, Luke wasn't necessarily the son of Vader, he wasn't necessarily the brother of Leia, but it was all possible. *The Force Awakens* has this incredible advantage, not just of a passionate fan base but also of a backstory that is familiar to a lot of people. We've been able to use what came before in a very organic way, because we didn't have to reboot anything. We didn't have to come up with a backstory that would make sense; it's all there. But these new characters, which *Force* is very much about, find themselves in new situations—so even if you don't know anything about *Star Wars,* you're right there with them. If you are a fan of *Star Wars*, what they experience will have added meaning.

"I know that when I see the *Falcon* with a rectangular radar dish, we're at a moment after it traded hands," Abrams says.



W — You mapped out the story with Lawrence Kasdan, who cowrote *The Empire Strikes Back* and *Return of the Jedi*. He said recently that his own life experiences—and the span of time not working on *Star Wars*—readied him to work on this film. Were there moments from your life or your own work from which you drew inspiration?

A — Working with Larry definitely ties for first in terms of incredible experiences I've had with this project. We all take our experiences with us from one project to the next, but in this case, I never looked to draw from my past work. More than anything, I drew on personal experiences as cautionary tales, things that I didn't want to do again. For example, I didn't want to enter into making a movie where we didn't really own our story. I feel like I've done that a couple of times in my career. That's not to say I'm not proud of my work, but the fact is I remember starting to shoot *Super 8* and *Star Trek Into Darkness* and feeling like I hadn't really solved some fundamental story problems.

The collaboration, for me, was an education in storytelling and doing so with clarity, with efficiency, brevity—wit. It was a little like taking an extended master class. And because he's also a director, he knew what

SCOTT DADICH (@sdadich) *is editor in chief of* WIRED.



I was going through in prep and in production, and he allowed for my needs. Sometimes those needs were practical, other times they were creative needs or feelings I had. But he was there to help that process, the same way I would have been if I had known he was directing. It was always about moving this thing forward in the right way, about making this movie the right way. I can't say enough about him.

So I tried to not forget the mistakes I'd made, but I also tried to focus on things that I find inspiring about cinema. I asked questions like "How do we make this movie delightful?" That was really the only requirement Larry and I imposed on each other: The movie needed to be delightful. It was not about explaining everything away, not about introducing a certain number of toys for a corporation, not about trying to appease anyone. This has only ever been about what gets *us* excited.

W —— Well, it comes through in the trailers. I remember waking up on Black Friday last year, my wife shoving her iPhone in my sleeping face. I heard the music and shot awake—I felt that excitement.

A —— That's great. What I'm excited about is that the movie itself feels like those teasers and not like the movie is one thing and the teasers are something else.

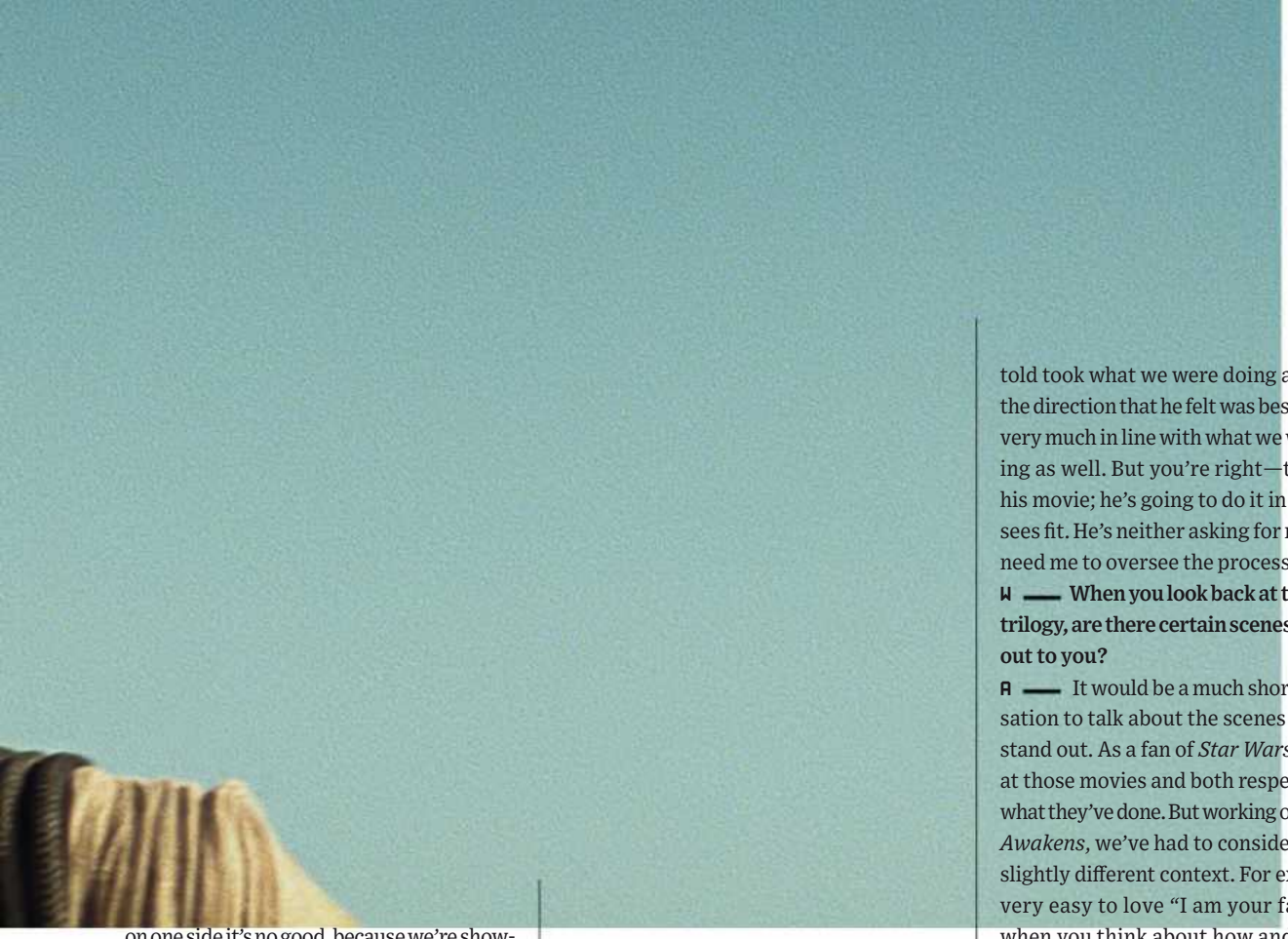
W —— One thing I know about you is that you love a mystery. You love to surprise an audience. How have you felt about those teasers—about revealing parts of the movie, necessarily talking about and marketing it, versus allowing the story to unfold on your terms?

A —— I give credit to, and frankly surprisingly so, the incredible people at Disney, especially Alan Horn [chair of Walt Disney Studios] and Bob Iger [Disney CEO]. Bob's been unbelievably collaborative and supportive of this entire process. When it came to marketing, I was expecting Disney to want to put out an overabundance of material. But they've been incredibly reluctant to do that. They want this thing to be an experience for people when they go to see the film. And I'm grateful for that.

There's a really positive side to keeping quiet. You can protect the audience from spoilers or certain moments that, in a way, obviate the movie experience. But on the other hand, you risk being seen as coy or as a withholding shithead. That's never my intent. Because Lucasfilm has been so engaged with the fans and so forthcoming about what they're doing, it would have felt oddly inconsistent to not show anything until just before the movie came out. I actually personally pushed to have a teaser come out a year before, just because it felt like, as a fan of *Star Wars,* if I could see even the littlest thing I'd be psyched a year out. Why not? So we did.

But I don't want to destroy too many illusions. We're walking a tightrope. If you fall

"THE **ONLY REQUIREMENT** THAT LARRY KASDAN AND I IMPOSED: THE MOVIE NEEDED TO **BE DELIGHTFUL**."



Daisy Ridley (Rey) is one of a handful of young actors charged with creating icons for a new generation of *Star Wars* stories.

on one side it's no good, because we're showing too much. If you fall on the other side it's no good, because we're not showing anything and we look like arrogant jerks.

W —— Is it gut? Where's the balance?

A —— You just have to kind of ask yourself at every turn, at every convention, at every opportunity, every promotion, "What feels right?" Of course, with this movie there are more licensing and merchandising balls to juggle than I've ever experienced. There are so many things, each one a little bit of a window into the story. It's not just about what piece you put out for a talk show. This is also about: Well, what does that character say as a toy in that particular line of action figures, as opposed to *that* one? We want to preserve some of the rarefied air of the actual experience and not open all the windows so it all just gets depleted.

W —— You can see how the universe gets so big so quickly, first toys and games and then *Episode VIII* and *IX*, with directors Rian Johnson and Colin Trevorrow coming aboard. I know *VIII* is Rian's movie, but you've no doubt created story questions in *Episode VII* that have to be addressed. Do you know how the answers play out? Or are those moments still unspooling?

A —— The script for *VIII* is written. I'm sure rewrites are going to be endless, like they always are. But what Larry and I did was set up certain key relationships, certain key questions, conflicts. And we knew where certain things were going. We had meetings with Rian and Ram Bergman, the producer of *VIII*. They were watching dailies when we were shooting our movie. We wanted them to be part of the process, to make the transition to their film as seamless as possible. I showed Rian an early cut of the movie, because I knew he was doing his rewrite and prepping. And as executive producer of *VIII*, I need that movie to be really good. Withholding serves no one and certainly not the fans. So we've been as transparent as possible.

Rian has asked for a couple of things here and there that he needs for his story. He is an incredibly accomplished filmmaker and an incredibly strong writer. So the story he told took what we were doing and went in the direction that he felt was best but that is very much in line with what we were thinking as well. But you're right—that will be his movie; he's going to do it in the way he sees fit. He's neither asking for nor does he need me to oversee the process.

W —— When you look back at the original trilogy, are there certain scenes that stand out to you?

A —— It would be a much shorter conversation to talk about the scenes that didn't stand out. As a fan of *Star Wars,* I can look at those movies and both respect and love what they've done. But working on *The Force Awakens*, we've had to consider them in a slightly different context. For example, it's very easy to love "I am your father." But when you think about how and when and where that came, I'm not sure that even *Star Wars* itself could have supported that story point had it existed in the first film, *Episode IV*. Meaning: It was a massively powerful, instantly classic moment in movie history, but it was only possible because it stood on the shoulders of the film that came before it. There had been a couple of years to allow the idea of Darth Vader to sink in, to let him emerge as one of the greatest movie villains ever. Time built up everyone's expectations about the impending conflict between Luke and Vader. If "I am your father" had been in the first film, I don't know if it would have had the resonance. I actually don't know if it would have worked.

We are making the first in a new trilogy of movies, and it's not very often that you get to work on something where you know there's a continuum, where you know it's basically part seven of nine—at least. That's a very interesting way to approach a story, and it's kind of great. It unburdens you. That's one of the gifts the original *Star Wars* gives so generously: When you watch the film the first time, you don't know *exactly* what the Empire is trying to do. You know they want to control by fear and you know they want to take over, but you don't really know all their plans. You don't really understand what it would be like for Luke to become a Jedi, let

alone who his father was. You don't really know what the Clone Wars were, or what the Republic was really about or what it looked like. All of those massive story elements are merely brushstrokes in *A New Hope*. In 1977, none of those things were clear to anyone and maybe not even entirely to George Lucas.

I cannot say enough about what George was able to do with that first movie, let alone the next ones. Forget how incredible it looked, forget the technology, forget the humor of it, the heart, the romance, the adventure—all the amazing moments that made us love it. Think about what he was able to stir up, the questions he was able to ask—exactly the *right* questions—the idea that he was able to create a world that clearly went so far beyond the boundaries of what we were seeing and hearing. This, to me, is one of the greatest things about *Star Wars*. Working on this new movie has been as much about trying to set up elements of what is beyond what you're seeing as it has been about telling a story that will be satisfying in and of itself. But it can't feel like a cop-out—like we're just setting things up and not resolving them.

W — But with a universe that vast, you have to think about constraint, right? You clearly have enjoyed a healthy budget and have had a big world to go invent. Were there particular limitations you wanted to put on either the process or the story, something that would help you focus on those goals?

A — I find that I am most happy when I have boundaries. With *Lost*, when ABC chairman Lloyd Braun called to say he wanted me to come up with a show about people who survive a plane crash, I remember thinking, "Well, I will come up with *that*," and I did—very, very quickly. What was great was he had given me a very specific assignment. So when I called him back and told him my thoughts, they were far weirder than what he would have ever expected. He was basically thinking about doing a kind of castaway show. But the constraint he imposed allowed the weirdness to kind of feel like fertile ground. Weirdness within limits, you know? If it had been *un*-limited—if he had called and said, come up with a weird show—I would have thought, I don't know! What does that even mean?

Star Wars is so boundless in terms of the world, the characters, the conflicts. When we began working on this film, Larry and I started by making a list of things that we knew held interest for us, the things we wanted to see, the things we felt were important. There's a very real issue with doing this movie: Every detail, whether it was the design of a costume or the music or a set-dressing choice, must be embraced as coming from *Star Wars*. You're inheriting *Star Wars*! That's not something you can do lightly. You have to really understand the design choices, because everything is important. At the same time, it's just *Star Wars*, meaning: It doesn't make it automatically interesting just because it's in that galaxy.

For example, when we were on-set and we were shooting a scene, it was always amazing to me to see Harrison Ford dressed as Han Solo. Or, wow, there's a guy—a stormtrooper!—and he looks exactly like a stormtrooper. Remember the feeling of the villain



Stormtroopers and X-wings may be the greatest eye candy in the world, but Abrams knows the story still has to work.

stepping off his ship? Or the sound of the TIE fighters when they roar past you? We've all seen TIE fighters roar past us now for nearly 40 years; what makes that interesting? The point is, these scenes aren't good just because those characters or things are there, even though it's the greatest eye candy in the history of time.

We really tried to look at it from the inside out. What makes this story have a beating heart? What makes it romantic or fun or surprising or heartbreaking or hysterically funny? We simply approached this narrative from the point of view that this is a story about a young man and a young woman, not with the idea that we can do anything we want.

W — I loved the anecdote in *The New Yorker*'s Jony Ive profile about you two brainstorming the design of Kylo's "spitty" lightsaber. Little details like that—or Threepio's red arm or the *Falcon*'s now-rectangular dish—drive us fans crazy wanting to know what's happened between *Jedi* and *Force*. How did you work with the design team; how did you go about tackling the production design?

A — It all started at the very beginning, when we were working with Michael Arndt, the first writer on the project. While Michael and I were collaborating, I invited our production designer, Rick Carter, into the story process. Just as it would be impossible to separate John Williams' score from the *Star Wars* movies, it was impossible to separate what Ralph McQuarrie and his design team had done from *A New Hope*. My sense was that the sooner Rick could be part of the process, the better. He's an incredible dreamer; his mind will go amazing places and dream up things you never would have imagined.

Very quickly, it became an incredible advantage to have Rick dealing with the designers and artists, prepping the conceptual work based on our story meetings. Almost immediately, designs would start to roll in that gave shape to the ideas we were working on. Moments like Threepio's arm came from the desire to, well, mark time.

It's almost like ...

W — Unknown events have transpired ...

A — Exactly. You know the moment when you reconnect with someone after years apart? You see the lines on their face, you think, oh, they've lived 10 years! Or when you see someone has a scar they didn't have—

> "YOU'RE **INHERITING *STAR WARS*.** THAT'S NOT SOMETHING YOU CAN DO **LIGHTLY**."



"WE WEREN'T CASTING ONE MOVIE—**WE WERE CASTING AT LEAST THREE.** THAT WAS THE BIGGEST CHALLENGE."

physical or emotional—you recognize it. It lets you know it's not two minutes later. It was important that Han Solo be Han Solo but not feel like he's playing a 30-year-old dude. When you're 70, you will have lived a different set of experiences. That has to be apparent in who he is. Harrison was required to bring a level of complexity that a 30-year-old Han wouldn't be required to have.

Then there were things like the radar dish on the *Falcon*, which clearly was ripped off in *Jedi*, so it needed a new one. But part of the decision was made as a fan. There's a part of me that wants to know: That's the *Falcon* from this era. Now I know that when I see the *Falcon* with the rectangular dish, we're at a moment after it traded hands. It also helped us mark time.

W — So: John Williams!

A — Oh my God! First of all, forget his talent and his achievement. As a person, he's the guy you want to know more than anyone. He is the sweetest soul I've ever met. He's like this jazzman who became one of the greatest composers of all time. He literally calls you "baby"! Like, "Hey, baby." He calls me "J.J. Baby." I waited all my life to meet someone who would call me that!

He works in pencil. You go to his home and listen to him play notes on the piano, and while you're listening, you extrapolate what it will be like when you hear the melody with an orchestra. It is unforgettable, a truly miraculous thing to behold. He has every one of his scores leather-bound. I was like, "Do you mind if I ...?" He goes, "No, go ahead!" So I pulled out the *Jaws* score, and sure enough, there it is, in pencil on paper: *baaaa-bum, baaaa-bum*. You're like, "Well, that's what he wrote!" It's as if you're hanging out with Mozart, who happened to score your favorite movies.

I know everybody knows this, but when you actually think about what he's composed, it is as important as any work ever done on any of those movies. When you think about *Superman* and *Raiders* and *Jaws* and *Close Encounters*—which came out the same year as *Star Wars*—and then the *Harry Potter* movies? He is just super-



human. It's unbelievable that he is as brilliant and yet as modest as he is. It's just an amazing thing to get to know that guy.

W —— A lot of this cast wasn't even born in 1977. How do you relay the legacy of what *Star Wars* means to people like you and me? Or is that a burden that you try to avoid?

A —— It's a really strange thing, when you think about being born into a world where it just *exists*. Despite their having been born horrifically recently, these kids knew about and understood *Star Wars* in a way we all do; they just were born into it as opposed to it happening during their lifetime. The key in casting them was finding people who were able to do everything. When you think about all that these characters go through, not just in this movie but knowing their work would continue, these individuals needed to be worthy bearers of this burden and opportunity to continue to tell the story. I think about the *Harry Potter* movies—that's unbelievable that they cast those films the way they did. And for what, eight movies?! That was a miracle. They needed to be able to do everything, and they all killed it.

We knew we weren't just casting one movie—we were casting at least three. That, to me, was the biggest challenge. When we met Daisy Ridley, when we found John Boyega, and then Oscar Isaac and Adam Driver came aboard, we got really excited. And yes, Daisy and John could work together, but what happens when Harrison's in the mix? What will that feel like? If it doesn't spark, it's a fucking disaster. Yes, BB-8 is a great character, amazingly puppeteered, but what will happen when he's suddenly in a scene with C-3PO or R2-D2? Will it feel bizarre? Will it feel wrong? Somehow it didn't. When Anthony Daniels told me, "Oh my God, I love BB-8!" I said, "We're going to be OK." Because if he's OK, it's working.

W —— C-3PO approves.

A —— Or seeing the sweetness between Han and Rey or the tension and comedy between Han and Finn. It was really exciting to say, "These scenes are working!" We worked really hard to cast and to write and to put it all together, but you just don't know until you start shooting. Then all of a sudden, you're on-set watching it and you *know*. It's a little bit like having a party and having friends from your new school meet friends from your old school, and you think, "What's going to happen?" And all of a sudden they're getting along famously and this party's really fun! It was a lot of work, but it ended up being great.

W —— So what's next? I know you were thinking up all-new, original ideas when Kathy Kennedy first called you for this job.

A —— My mom used to do this thing where we'd be eating lunch and she'd say, "So what do you want for dinner?" And I'd say, "Mom! We're eating lunch. We're literally just starting to eat lunch." I feel like I just need to finish my lunch. Right now, I just want to get this film into the world. W



Kylo Ren: The dark side is strong with this one.

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FILM

STAR WARS: THE FORCE AWAKENS

PROP TABLE

HELMETS & WEAPONS

At its core, *Star Wars* is about the fight between good and evil, and for that you need tools of war—whether it be a battered X-wing pilot's helmet or a Wookie's bowcaster. But whatever their fictional origins, these props were inspired by objects from our world. Hokey religions and ancient weapons are no match for Han Solo's blaster, but that blaster is based on the German Mauser pistol. Those tough-to aim Stormtrooper rifles? Modeled on the Sterling submachine gun. And just like here on Earth, the arms in the *Star Wars* universe evolve over time. Consider the iconic lightsaber—an elegant weapon from a more civilized age—which has morphed into Kylo Ren's fire-breathing crossguard weapon (far right). The forked saber may be new in that faraway galaxy, but the similarity to an old European sword is neither clumsy nor random.

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1. Sonn-Blas F-11D blaster rifle
2. X-wing starfighter pilot helmet
3. Snowtrooper helmet
4. Captain Phasma's blaster
5. X-wing starfighter pilot helmet
6. Huttsplitter blaster
7. Blaster pistol
8. Blaster rifle
9. BlasTech EL-16 blaster
10. Blaster pistol
11. Blaster rifle
12. Eirriss Ryloth Defense Tech Glie-44 blaster pistol
13. Trandoshan doubler on target pistol
14. Dasha Promenti's blaster pistol
15. Projectile rifle
16. Flametrooper helmet
17. X-wing starfighter pilot helmet
18. Special Forces TIE fighter pilot helmet
19. Chewbacca's bowcaster
20. BlasTech EL-16HFE blaster rifle
21. Trandoshan tripler on SoroSuub
22. Blaster pistol
23. Blaster rifle
24. Han Solo's BlasTech DL-44
25. X-wing starfighter pilot helmet
26. First Order officer's blaster
27. TIE fighter pilot helmet
28. LPA NN-14 blaster pistol
29. Kylo Ren's lightsaber

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BY
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THE FORCE WILL BE

120

STAR WARS AND THE QUEST FOR THE FOREVER FRANCHISE




WITH US.
ALWAYS.
ULISES FARINAS
DOCK VII

KATHLEEN KENNEDY HAS HEARD A LOT OF MOVIE PITCHES.



For decades she worked with Steven Spielberg, producing *E.T. the Extra-Terrestrial*, the *Indiana Jones* series, the *Jurassic Park* series. You get the picture. So it probably wasn't a surprise—it was cool, even—when, right after Kennedy took over as head of Lucasfilm, the company George Lucas founded to make *Star Wars*, John Knoll walked into her office.

Knoll is not nothing, either. He's the chief creative officer at Lucasfilm; he did the visual effects on the *Star Wars* "special editions" of the 1990s and a couple of *Star Trek* movies, among others. Along the way he cocreated Photoshop.

This was 2012, and even then, it was pretty clear Lucasfilm was going to make more *Star Wars* movies. "I just have this very simple idea," Knoll said, "about the rebel spies in the opening crawl of *A New Hope* who steal the plans for the Death Star."

Kennedy got Knoll's reference, of course. It's at the beginning of the movie, in the ribbon of text that sets the scene: "Rebel spies managed to steal secret plans to the Empire's ultimate weapon, the Death Star." The plans are the MacGuffin, the thing everyone is chasing. The spies? No one mentions them again.

"That is a very good idea, John," Kennedy said.

So ... green light. Apparently that's how you get to make a *Star Wars* movie.

But not *this* movie. The one that comes out December 18 is not Knoll's sci-fi spy story. It's director J.J. Abrams' *The Force Awakens*, the seventh—oops, sorry: VIIth—movie to tell the story of Darth Vader's family. Knoll's idea became *Rogue One*, due out in December 2016. It's a stand-alone story—an "anthology" movie as opposed to a "saga" movie, in Lucasfilm parlance.

The picture that the Lucasfilm faithful relentlessly call *A New Hope* but everyone else calls *Star Wars* came out in 1977. It and its sequels (and TV movies and cartoons and toys and bedsheets) burrowed deep into popular culture. And if the people at the Walt Disney Company, which bought Lucasfilm for $4 billion in 2012, have anything to say about it, the past four decades of *Star Wars* were merely prologue. They are making more. A lot more. The company intends to put out a new *Star Wars* movie every year for as long as people will buy tickets. Let me put it another way: If everything works out for Disney, and if you are (like me) old enough to have been conscious for the first *Star Wars* film, you will probably not live to see the last one. It's the forever franchise.

These new movies won't just be sequels. That's not the way the transnational entertainment business works anymore. Forget finite sequences; now it's about infinite series. Disney also owns Marvel Comics, and over the next decade you can expect 17 more interrelated movies about Iron Man and his amazing friends, including *Captain America: Civil War*, two more Avengers movies, another Ant-Man, and a Black Panther (not to mention five new TV shows). Thanks to licensing agreements, Disney doesn't own the rights to every Marvel property—Fox makes movies about the X-Men and related mutants like Gambit and Deadpool. So you'll get interrelated comic-book movies there too. Warner Bros. Entertainment, which owns DC Comics, is prepping a dozen or so movies based on DC characters, with *Batman v. Superman: Dawn of Justice* and *Suicide Squad* in 2016, *Wonder Woman*, and eventually the two-part team-up *Justice League*. Warner is also trying to introduce Godzilla to King Kong (again). Paramount is working on a shared universe for its alien robot Transformers. Universal continues, with limited success, to try to knit together its famous bestiary (Frankenstein's monster, Dracula, the Wolf Man, the Mummy, etc.).

Everywhere, studio suits are recruiting creatives who can weave characters and story lines into decades-spanning tapestries of prequels, side-quels, TV shows, games, toys, and so on. Brand awareness goes through the roof; audiences get a steady, soothing mainline drip of familiar characters.

Forget the business implications for a moment, though. The shared universe rep-

Kennedy, who oversees the *Star Wars* franchise for Lucasfilm, has produced 93 films in her career.

DAN WINTERS



resents something rare in Hollywood: a new idea. It evolved from the narrative techniques not of auteur or blockbuster films but of comic books and TV, and porting that model over isn't easy. It needs different kinds of writers and directors and a different way of looking at the structure of storytelling itself. Marvel prototyped the process; Lucasfilm is trying to industrialize it.

Nonfans might scoff, but the universe of *Star Wars* has more than an audience—it has followers. And followers are emotionally invested, which makes redeveloping it a daunting task. "The first question J.J. asked us when we all sat down was, what do we want to feel?" Kennedy says.

The answers Kennedy's brain trust gave: A sense of a beginning. A sense of urgency but also humor. Working with Lawrence Kasdan, who wrote *The Empire Strikes Back* and *The Return of the Jedi*, Abrams developed another list: "The feeling we wanted was from the first trilogy," Kasdan says. "It's fun, it's delightful, it moves like a son of a bitch, and you don't question too much."

Kennedy's main office is in San Francisco, but these days she's spending most of her time behind a standing desk at Pinewood Studios, outside London, where *Rogue One*'s production sprawls across seven soundstages. She has a 4K screen that connects to the editing bays and server farms where Abrams is assembling *Force Awakens*. *Episode VIII* is in preproduction down the hall, and stand-alones about young Han Solo and the fan-favorite bad guy Boba Fett are percolating. It seems complicated. It seems, I say to Kennedy, like you're going to need more than just emotions to make it all work.

"I love how you've already jumped to the conclusion that it's all working," she answers, laughing. "Oh my God, there is so much to get right. It's by no means laid out beat for beat. I'll borrow a line from *Raiders of the Lost Ark*: We're making this up as we go."

J

[redacted]

JUMP BACK TO 1978. Lawrence Kasdan hands George Lucas his first draft of the script for *Raiders of the Lost Ark*. (Yeah, he wrote that too.) Lucas drops the pages on his desk; he has something more urgent on his mind. Will Kasdan write the sequel to *Star Wars*? See, the original writer, Leigh Brackett, has died of cancer. They're building sets, and they don't have a script.

"Maybe you ought to read *Raiders* first," Kasdan says.



Kennedy (left, in white) talks to Abrams (at table, center) and team on the *Millennium Falcon* set.

"I'm going to read it tonight," Lucas answers. "If I don't like it, I'll call you tomorrow and take back this offer."

And that, apparently, is *also* how you get to make a *Star Wars* movie. Kasdan had six weeks. The best part? "George said to me, 'Darth Vader is Luke's father.' And I said, 'No shit?' I thought that was the greatest thing I'd ever heard." Kasdan realized that *Empire* was actually a second act. Movie structures, especially in genres like sci-fi, have a certain ... let's not say *predictability*. Let's say *approach*. I'm just parroting the basic how-to texts of screenwriting here: Three acts—setup, confrontation, and resolution (with plot points at the transitions)—and act three recapitulates and resolves the tensions you carefully laid down in act one. *Star Wars* had all those things on its own, but now, Kasdan saw, *Empire* would be act two in an even bigger superstructure. "The second act is always the best act," he says, "because everything goes wrong and there's a huge question at the end."



OK, now: Flux capacitor, Tardis, Omni, whatever—we jump forward to 2012. Kasdan is talking to Lucas again, and Kennedy too, and they want him to write another—another!—*Star Wars*. It turns out Lucas has been sitting on a whole crop of ideas. "Pick," they tell him. Kasdan chooses something about Han Solo when he was a kid. "Because Han is my favorite character," Kasdan says.

They cut the deal, but ask Kasdan for a little more. Could he stick around and, you know, consult a little bit on *Episode VII*? Could he help persuade Abrams to take the directing chair?

Then it was *Empire* all over again. The original writer, Michael Arndt, had fallen behind. People were already getting hired and money was being spent, so Abrams and Kasdan stepped in. "We started walking around, recording into an iPhone and breaking the story," Kasdan says, using Hollywood jargon for outlining a plot. "We walked for miles, through Santa Monica and Manhattan and eventually Paris and London." Kasdan says the only must-have item was to bring back Han, Chewie, Luke, and Leia. "On the first day, I said, look: *Delight*, that's the word. In every scene, that should be the criterion we're using. Does it delight?"

Of course, Abrams and Kasdan had a whole new kind of pressure. They weren't writing a second act. They were writing a new ending and a new beginning. "I do feel like there's a little bit more of a burden on Larry and me to come up with a story that could at least be the beginning of what transpires over three films," Abrams says. Hollywood's studios have always been Fordist enterprises, but as Abrams and Kasdan discovered, making this new kind of sausage takes an entirely new set of tools.

They're not the only ones trying to figure it out. Take, as a separate example, *Captain America: The First Avenger*, a 2011 Marvel movie about the patriotic World War II hero. Stephen McFeely and Christopher Markus, writing partners who'd worked on a handful of Narnia movies, loved the idea of a superhero movie set in the 1940s. But that doesn't mean they got to do whatever they wanted with the story. Quite the opposite. They were adapting and distilling an existing corpus: seven decades of Captain America comic books. So they didn't have to invent their proper nouns. Mentor figure? Check: Abraham Erskine, the scientist who turns little Steve Rogers into Captain America. MacGuffin? Check: the reality-warping Cosmic Cube. ("I'm not positive whether Marvel said, 'What about the Cosmic Cube?' and we said, 'That's as good as anything,' or if it was the other way around," McFeely says.) Bad guy? Check: "First-draft choice of a villain is the Red Skull," he says. "It's not a mandate, but you circle it very quickly."

By the time *Cap* was in development, a larger strategy had emerged at Marvel Productions. The movie had to call back to the database of comic history but also communicate with the existing and future Marvel Cinematic Universe. That's where all those references and allusions come in: They're connective tissue. "We knew there was an *Avengers* coming, so that dictates the story in a way. And for us, that's helpful," McFeely says. "If I know Steve Rogers has to crash into the ice in this movie so that in either this one or the next one he can wake up, that gives us a place to end up."

Despite the insistence among people who make shared-universe movies that each one must stand alone in terms of story and quality, breaking a movie that's the third one in the second phase of a seemingly never-ending cycle can be tough. You can't, I don't know, kill Commissioner Gordon. How do you integrate Samuel L. Jackson showing up to talk about the Avengers in *Iron Man*? "During the production, we started saying to [director Jon] Favreau things like, 'We think Sam Jackson is going to do this,' and he'd say, 'How the hell is that going to connect to the story?'" Kevin Feige, Marvel's lead producer, told me at San Diego Comic-Con a couple of years ago. "And we'd say, 'It doesn't, so let's put it at the end of the credits.'" Those sidewise glances at other stories used to be vestigial; in more current Marvel movies, they're intrinsic. Want to know where Nick Fury gets the helicarrier that saves the day at the end of *Avengers 2*? You should've been watching the *Agents of S.H.I.E.L.D.* TV show.

That wreaks havoc on beginnings, middles, and endings. No one ever makes a true act three. The universe never ends, really. It ebbs and flows from individual, single-character-focused movies through

THE SHARED UNIVERSE REPRESENTS SOMETHING RARE IN HOLLYWOOD: A NEW IDEA.

THE FRANCHISE CAN EXTEND **10,000 YEARS** FORWARD OR BACK FROM THE **MOMENT THE DEATH STAR EXPLODES.**

big *Avengers* denouements. The quantum realm in *Ant-Man* sets up the mystical world of *Doctor Strange*. The alien nature of Asgard in *Thor* sets up the science fiction of *Guardians of the Galaxy*.

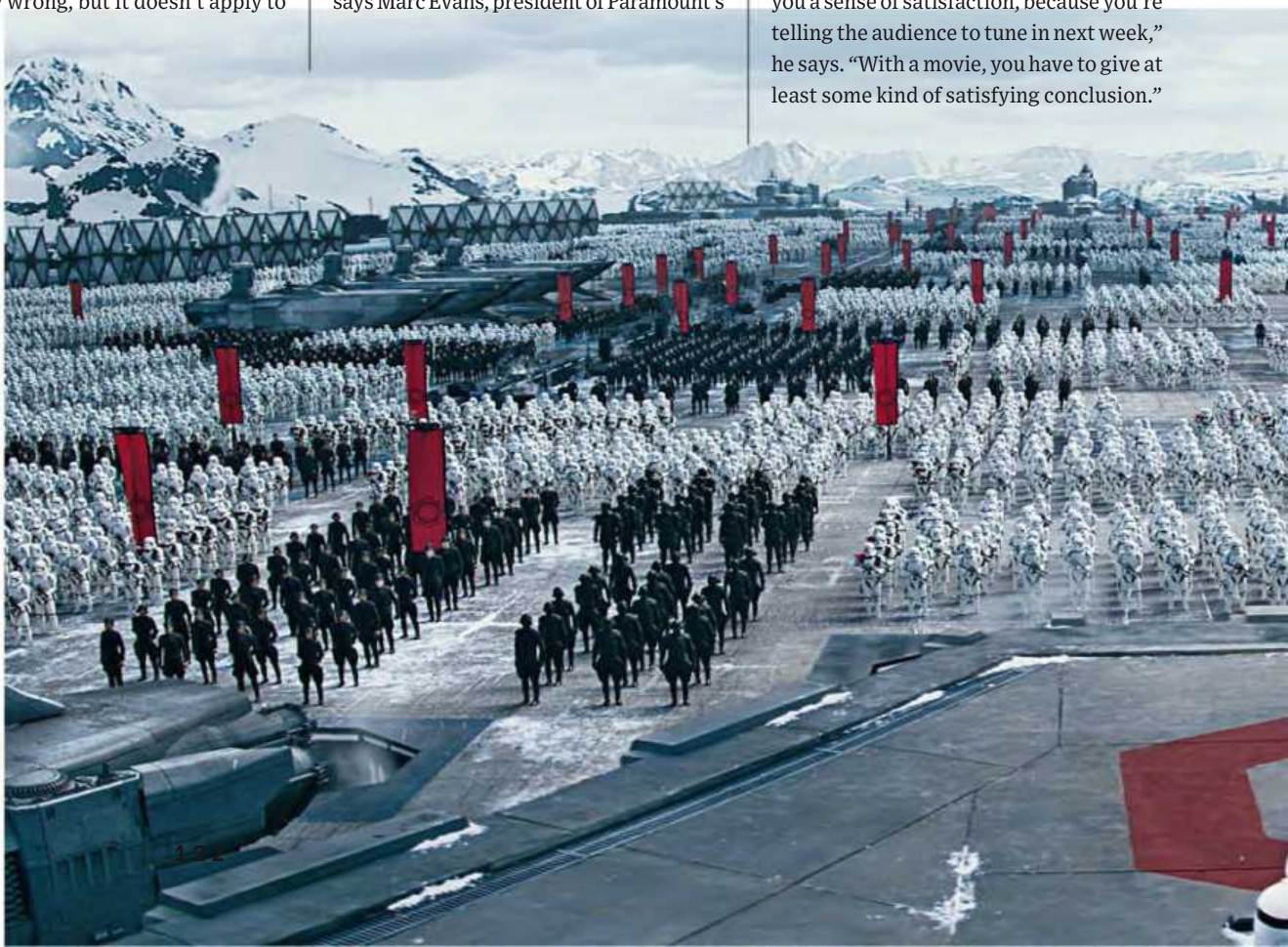
In that framework, the auteur gives way to the team player. The myth of the screenwriter as a loner who vanishes into a Starbucks purgatory for a couple of years and returns with a script isn't necessarily wrong, but it doesn't apply to universe-building. Paramount has structured its *Transformers* team explicitly like a television-series writers' room, with a showrunner and multiple writers all working on individual stories and the overall arc, following a story bible that establishes themes, tone, characters, and even plot twists. It's a text for subtext. "In the *Transformers* room, the writers are just at a stage now to present their ideas," says Marc Evans, president of Paramount's Motion Picture Group. "Sometime in the next couple of days, somebody is going to hand me a beautiful *Transformers* story bible, and it'll be great weekend reading."

In preproduction on the two *Captain America* movies, McFeely and Markus would meet with the directors, Anthony and Joe Russo, to talk about the story and script. But also at the table was an executive from Marvel with an eye on the bigger universe, who reported back to Feige. "For the big decisions, Kevin has got to weigh in," McFeely says. "It has always been helpful."

That collaboration is equally intense on *Star Wars*. Abrams had Kasdan and Kennedy, of course, and also Lucasfilm's Story Group, a team dedicated to maintaining connections across every medium. To them add all the people working on future movies. All of them have to interact, to find the ways their stories connect to one another.

Abrams also created the TV shows *Alias* and *Lost*, so I ask him: Is making the first movie in the new cycle something like writing a TV pilot?

"Yes, although in fairness a pilot obviously doesn't require a finale that gives you a sense of satisfaction, because you're telling the audience to tune in next week," he says. "With a movie, you have to give at least some kind of satisfying conclusion."



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THE BEST *STAR WARS* stories from the past 40 years share an essential quality. "Whether it was a prop, a backing on a set, a color choice, there were constant conversations—no, no, no, that doesn't look like *Star Wars*," Kennedy says. "I think it's part of what was intuitively driving George. I guess you could jokingly say it was the Force."

Right. "Jokingly."

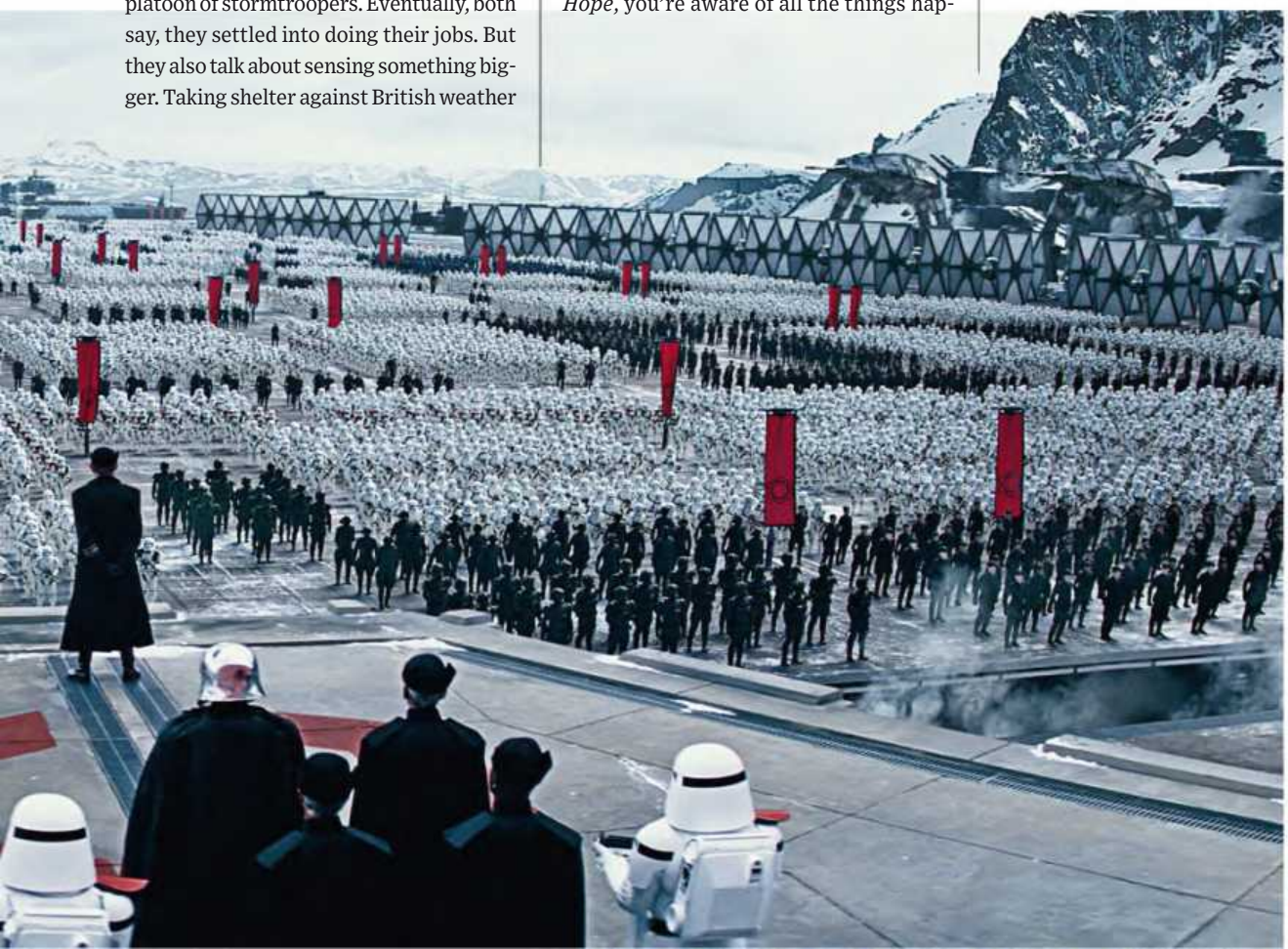
Both Abrams and *Rogue One* director Gareth Edwards admit to having been dazzled by their first days on a *Star Wars* set, paralyzed by the coolness of being near Harrison Ford in a Han Solo costume or a platoon of stormtroopers. Eventually, both say, they settled into doing their jobs. But they also talk about sensing something bigger. Taking shelter against British weather beside a towering set I've been asked not to describe, Edwards—covered in black diesel soot and weighed down by gear—looks damn happy. "I feel I know this universe," he says. "It feels like going back home, the place you live in your fantasy life."

All these people are describing more than just a franchise. What they're talking about is a *paracosm*, psychology-speak for an imaginary world. Lots of little kids have them—especially creative ones. So do writers. Think Narnia or Yoknapatawpha County. J. R. R. Tolkien's Middle-earth is an obvious example, with its multiple languages, cultures, and thousands of years of history.

Like tales from Middle-earth, stories set a long time ago in a galaxy far, far away seem to have leaked through a boundary between here and there—as if things are happening in the *Star Wars* universe even when no one is looking. *A New Hope* created the effect through allusion, just as Marvel and DC movies now do. But in *New Hope*, the allusions were to a canon that didn't exist. It's hard to remember, after decades of accumulated story cruft, that when we first heard of the Imperial Senate or the Clone Wars, we didn't know what they were. "The first time you watch *A New Hope*, you're aware of all the things happening offscreen," says Kiri Hart, who runs the Lucasfilm Story Group. "It feels real." Obscure yet familiar, the ideas seem more alive, like the ads for life off-world in *Blade Runner* or the Weyland-Yutani corporate logos in *Alien*. This is why fantasy novels and *Game of Thrones* have imaginary maps as frontispieces.

Television can be particularly paracosmic. By my count there are roughly 710 hours of in-canon *Star Trek* movies and television encompassing—thanks to time travel and mirror universes—more than 14 billion years of history. That's a big paracosm, with a lot more room for stories. "I often think about the areas of the *Star Trek* universe that haven't been taken advantage of," Paramount's Evans says. "Like, I'll be ridiculous with you, but what would *Star Trek: Zero Dark Thirty* look like? Where is the SEAL Team Six of the *Star Trek* universe? That fascinates me."

This does not sound ridiculous. It sounds so freaking cool that I have to take a moment.



The villain, Kylo Ren (Adam Driver), stands before the troops of the First Order in *The Force Awakens*.

[redacted]

TO MY MIND, CHRIS CARTER perfected the television paracosm when he created *The X-Files*. He figured out how to structure parallel tracks of multiseason stories with stand-alone episodes. It made the universe feel big.

In fact, TV writers' rooms lend themselves to paracosm-building. A given writer might get interested in a specific facet of the universe, while the showrunner maintains tone and quality control, as Marvel's Feige or Lucasfilm's Kennedy are now doing. It's probably no accident that many of the successful shared-universe directors and writers have television backgrounds (Joss Whedon, the Russo brothers, and Abrams himself).

TV also gives writers and producers more room to fail, to have the occasional not-so-good episode. Movies are less forgiving. "If you go slightly to the left, it's not *Star Wars*," Edwards says, "and slightly to the right, it's a karaoke number."

You may notice that all these paracosms have something else in common: nerds.

Maybe that's because they find their fullest expression in comic books. People rightly credit Stan Lee and his cocreators at Marvel in the 1960s with building a tightly interrelated universe, one where heroes with their own books could also work together as Avengers or Defenders or whatever. Spider-Man and the Human Torch were friends. Avengers Mansion was on Fifth Avenue. Over at DC, Batman and Superman have been sharing adventures since the 1940s.

The details don't matter as much as the volume of intellectual property floating around out there—nearly a century of stories; tens, if not hundreds, of thousands of pages, all connected. That's the vein today's movie-universe writers are mining. "It's not like I created Captain America," McFeely says. "There are other keepers of the flame."

Lucas was the original keeper of the *Star Wars* flame, but now we all live in his paracosm. And come to think of it, maybe comics aren't the best analogy; this is more like Dungeons & Dragons. (I mentioned: nerds.) Shared universes are distributed paracosms. The allusions frame out a world, and our imaginations build the rest—so we become invested in that alternate reality, not only as consumers but as participants.

It can all go south, of course. The whole endeavor could become crass, commodified. Eventually a distributed paracosm might just feel like branded content, like every movie and TV show and Lego set is just a commercial for other movies, TV shows, and Lego sets. "We all have to be careful of the *Who Wants to Be a Millionaire* trap," Evans says. "When that show premiered and was once a week, all I wanted to do was tune in. The minute they changed it to five days a week, it seemed a lot less special. Let's not flood the market." This is the shared universes' shared Ragnarök—dozens of movies with impenetrable interconnectivity floating amid a sea of unending remakes, reboots, rewarmings. For those of us with emotional investments in these characters and these worlds, that would be heartbreaking, like the commercial in which Fred Astaire dances with a vacuum cleaner.

[redacted]

ABRAMS' *STAR TREK* movies were fine. But he acknowledges, now, that the rational, scientific, boldly-going *Trek* paracosm didn't resonate with him when he was a kid. *Star Wars*, though? After just a few minutes with Abrams, it's clear that he left half his soul on Tatooine in 1977, and he plans to take us all back there to get it. Sure, that'll mean TIE fighters and X-wings, lightsabers and cute droids, and a high-speed chase or two. But it's also humor and heart, romance and adventure, speed and destiny.

Plus, he and the rest of the *Star Wars* team have an advantage: time.

I'm not talking about how long they have to make the movies; I'm diving into the paracosm now. It's too early to judge the nascent cinematic shared universes like *Transformers*, but I have a hunch that paracosms based on comic books will have a problem with late middles and endings. In comic books, superhero universes survive in part because of what Stan Lee famously called "the illusion of change." The status quo looks like it's constantly evolving, because our hero defeats the latest threat, but really everything just resets to zero. Time, in comics, stands still.

But in the *Star Wars* universe, time moves. Han Solo, Princess Leia, Luke Skywalker, and the legacy actors playing them can grow from callow youth to wise old age and then pass the torch. Literally. Like, count on a lingering scene of one of those olds offering a lightsaber to one of the new kids in *Force Awakens*. The universe can extend for 10,000 years forward and back from the moment Luke blows up the first Death Star. "In the case of *Rogue One*, we're essentially making a period piece," Hart says. "The benefit of making additional episodes that move forward on the timeline is that we are making new space for ourselves."

Every shared universe can expand, but the *Star Wars* paracosm's particular structure can do it along the *x*-axis, taking the heat off of any single narrative moment. Comics universes really only expand along the *y*- or *z*-axes, if you see what I mean—more characters or more locales. Robert Downey Jr. can play Iron Man for only so long. If you want to keep making Marvel movies, you're going to need a new Iron Man or a new universe. That doesn't make them bad. It just makes *Star Wars* different. "*Star Wars* is its own genre," Kasdan says. "Like all genre, it can hold a million different kinds of artists and stories. They say 'Buddha is what you do to it.' And that's *Star Wars*. It can be anything you want it to be."



Kasdan should know; besides Lucas, perhaps no person has done more to define *Star Wars*. So it's a little ironic that the line he says is his favorite of everything he's written comes instead from *Raiders*. It's the one Kennedy quoted: I'm making this up as I go. "For you and me, we're making it up. Here's how I'm going to behave, here's what I'm willing to do to make a living, here's what I'm not willing to do. How we make up our lives as we go," Kasdan says. "That's such a powerful idea. It's exciting. The biggest adventure you can have is making up your own life."

That's certainly what George Lucas was doing in the early 1970s. His nascent paracosm, about a universe where a farmboy with preternatural skill as a pilot could turn out to be a messianic warrior-priest, didn't exactly fit in with the gritty, violent stories his peers (or even his mentor, Francis Ford Coppola) wanted to tell. All he had was a document laying out the long arc. It was naive and nostalgic, but amid the weird names and clichés was a real vision. "The movie cost $8 million. He certainly wasn't thinking of a blockbuster," Kennedy says. "It was deeply personal to him. He was looking for meaning. It was authentic to who he was."

J.J. ABRAMS LEFT HALF HIS SOUL ON TATOOINE IN 1977. NOW HE'S TAKING US BACK TO GET IT.

That's the future in front of Kennedy: building out a universe that someone loved so much he made the rest of us love it too. It's like continuing the construction of a cathedral someone else designed, or being the commander of a generations-long starship mission. It is an honor, but I suspect also a burden. Kennedy has made nearly 100 movies in her career, not all about dinosaurs and ray guns. Maybe, I ask, she might want Lucasfilm to make something else? Something new?

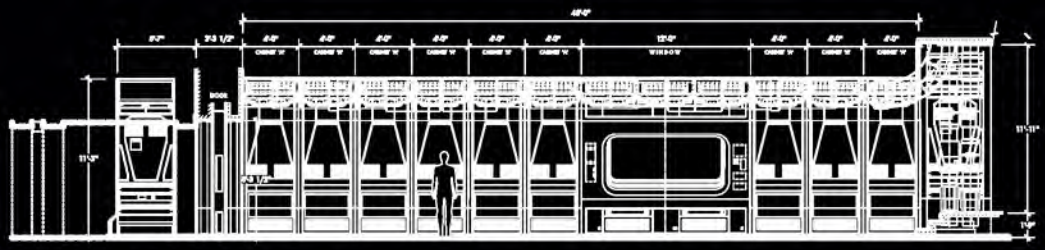
"I've talked about it with everybody at Disney. Alan [Horn, chair of Walt Disney Studios] is very supportive of it. But at the same time, he's right when he says we've got a lot on our plate," Kennedy says. She takes a breath. "And then I'll be working with them on *Indiana Jones*."

New *Indiana Jones*. I need to take a moment. W

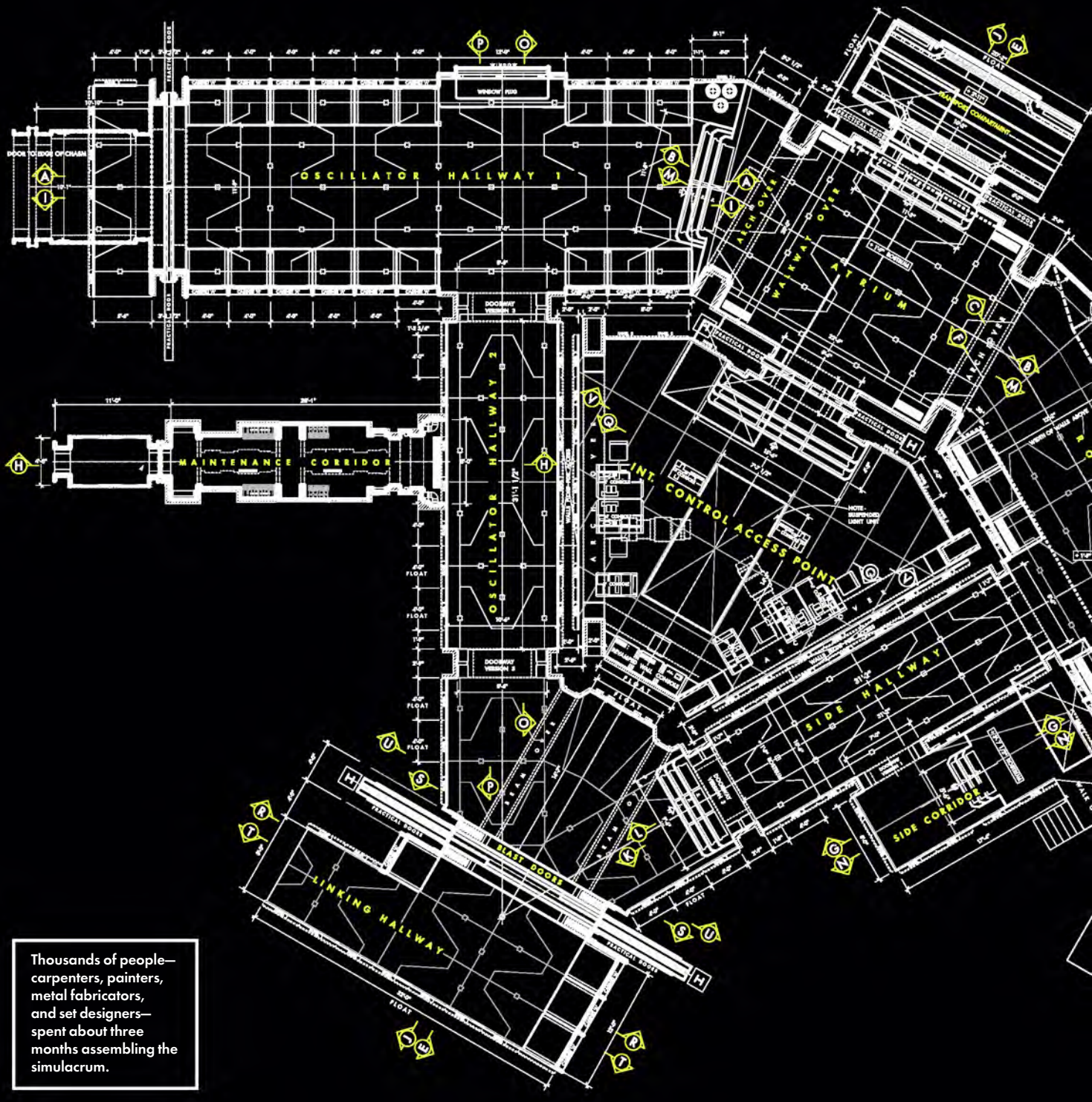
Articles editor **ADAM ROGERS** (@jetjocko) *wrote about the JoCo Cruise in issue 23.01.*



Abrams' *Star Wars* movie connects familiar sights from the original film to a new cast—and a new audience.



The all-purpose set can be reconfigured, Lego-style, in a variety of specific configurations, says Darren Gilford, a production designer.



Thousands of people—carpenters, painters, metal fabricators, and set designers—spent about three months assembling the simulacrum.

SET

STARKILLER BASE

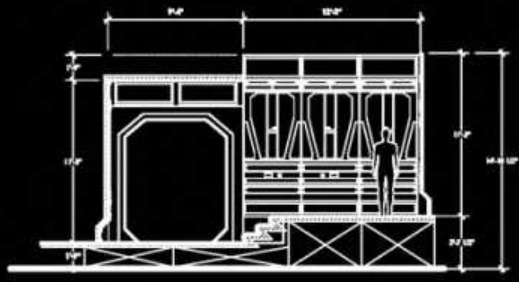
DETAIL

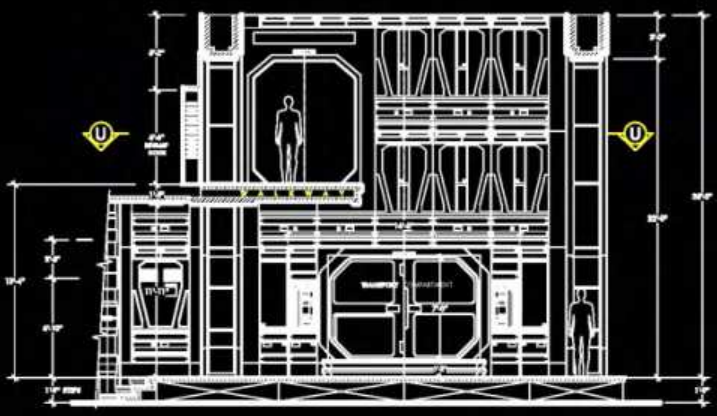
PLAN & ELEVATIONS

SCALE

1 inch = 14 feet

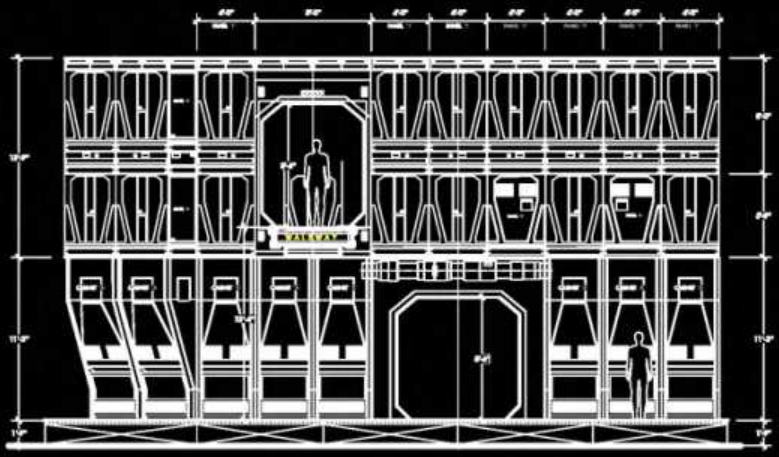
The Empire may have collapsed in *Return of the Jedi*, but evil still lurks in the universe, and it needs a headquarters. This is the construction blueprint for the interior of the Starkiller Base, seat of the First Order's power. (It was known on-set and in production designs by the codename "Evil Castle.") In *The Force Awakens*, it's a monstrously huge structure, full of twisting hallways, long corridors, and a central control room. But in real life, the mostly wood-and-plastic set occupied a single soundstage at Pinewood Studios in London—and movie magic was the Force that turned it into the new Death Star.



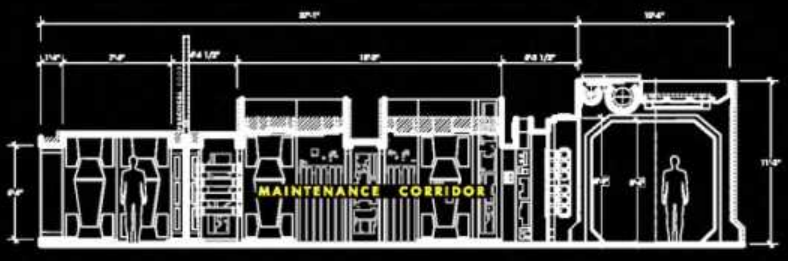




Wall panels—called cabinets—can be flipped upside down to transform hallways into entirely different-looking corridors of the base.



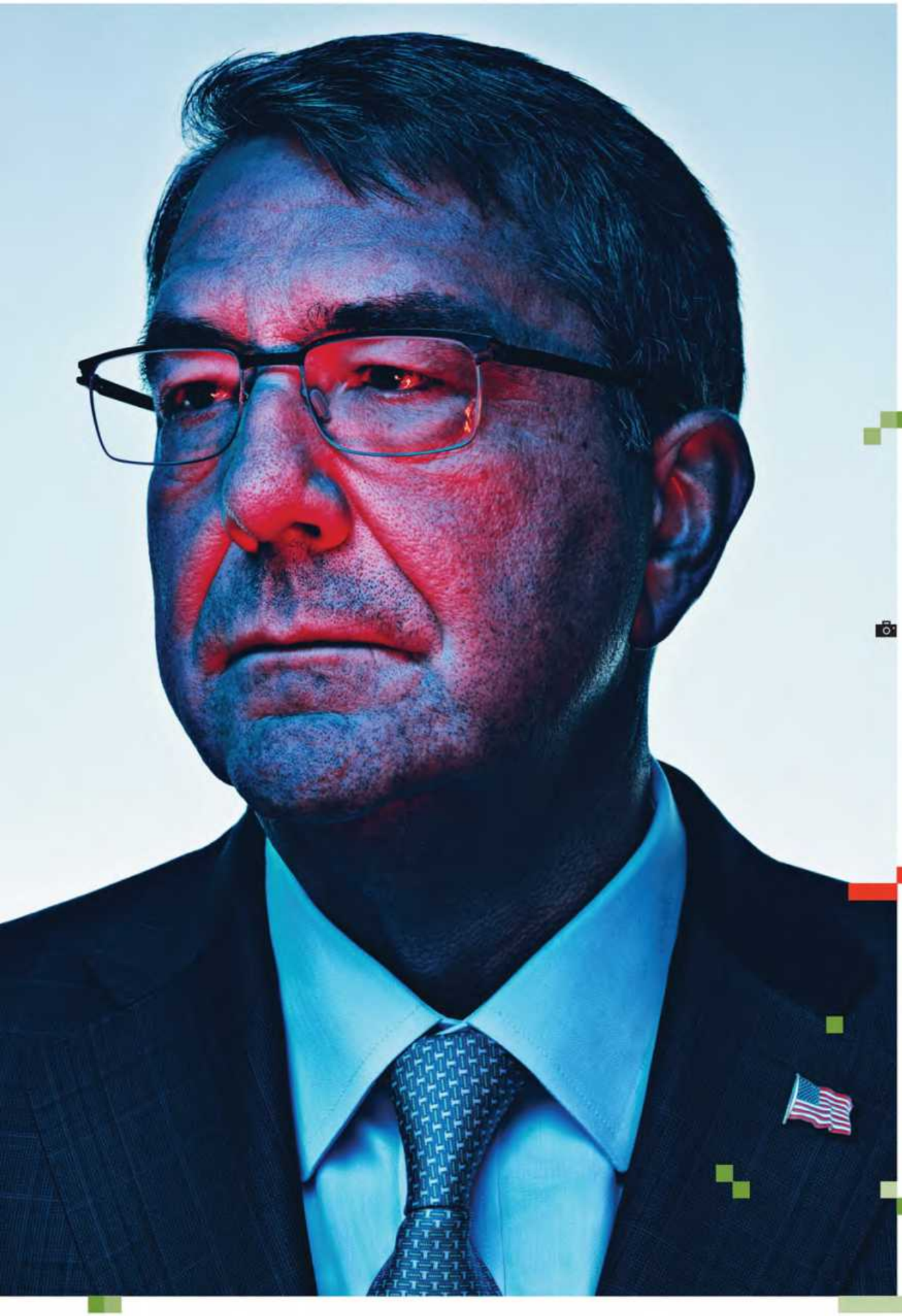
Materials mostly included wood, vacuum-formed plastic, steel, and plaster. Rock was also used to give parts of the base a subterranean look.



MILI-TARY. INDUS-TRIAL. COM-PLEX.

by Jessi Hempel





Sebastian Kim

How secretary of defense Ashton Carter is transforming the US military—by reintroducing it to Silicon Valley.

The "Doomsday Plane" weighs 800,000 pounds when fully loaded and can withstand the effects of a nuclear bomb or asteroid blast while remaining aloft for 12 hours without refueling. First deployed in 1974, the Boeing E-4B has been the preferred mode of long-range transportation for US secretaries of defense ever since. But when Ashton Carter's staff discovered the behemoth would literally crush the runway in Sun Valley, Idaho, where he planned to attend the annual gathering of tech elite at the Allen & Co. conference, the SecDef nimbly switched to a sleek Gulfstream V. He jetted in with just a few aides, his wife (the conference is something of a family affair), an overnight bag weighing less than 10 pounds—and the message that the US military has a new spirit of agile entrepreneurialism.

The DOD of course has a long history of jump-starting innovation. Historically, it has taken the megafunding and top-down control structures of the federal government to do the kind of investing required to create important technology for the military. Digital photography, GPS, the Internet itself—all were nourished by defense contracts before being opened up to the private sector, which then turned them into billion-dollar industries.

Now the flow has reversed. Defense has been caught in the throes of the same upheaval that has disrupted legacy industries, unseated politicians, and upended global dynamics. In the digital age, innovation more often comes from smaller entrepreneurs than from the hierarchical structures that were the hallmark of 20th-century government and business. Over the past decade, the cost of computing has plunged, enabling anyone with a laptop to launch globe-spanning enterprises (see: Facebook, Uber, Square). Sure, the Pentagon's R&D arm, Darpa, continues to incubate forward-thinking ideas, but it's planning for a distant future; across town at the Pentagon, many computers are still running software that was programmed in the 1980s—long before many of today's soldiers were born.

More broadly, this disruption has made it a lot harder to protect the world's biggest superpower. Enemies of the US were once mainly hulking nation-states. But the biggest tech breakthroughs of the past decade—smartphones, social networking, cloud computing, drones—have put the tools of warfare into anyone's hands, including terrorists, militant groups like the Islamic State, and hacker collectives for hire by authoritarian governments. As Moises Naim wrote in *The End of Power*, "In the 21st century, power is easier to get, harder to use—and easier to lose."

The task falls to Carter to pilot the 2.2 million-member armed services—whether the 10,000 soldiers on duty in Afghanistan for the foreseeable future or the 1,000 pros staffing the US Cyber Command—into a world where swift-moving strategy is more important than brute force, and a global military needs both. Carter, who has been in the job for 10 months now, is betting heavily on Silicon Valley. He believes the hardware and software its engineers and entrepreneurs dream up have unlimited potential to help the military do its job. What's more, he argues, Silicon Valley—and tech entrepreneurs more broadly—can teach Defense a lot about flexibility, speed, and new ways to work.

For its part, the tech sector remains wary. Defense contracting is notorious for bureaucratic lethargy and technological backwardness. And executives are leery of appearing to be too close to the US government while they seek to expand overseas. Put bluntly, they don't want to alienate potential customers. (Case in point: Execs from Apple, Facebook, and Microsoft met with Chinese president Xi Jinping in late September in Seattle even as the Obama administration considered sanctions against China for cyberespionage.) And more than two years after former contractor Edward Snowden leaked documents revealing the National Security Agency, which is run by Defense, had penetrated Facebook, Google, and other companies, many in Silicon Valley still hold a grudge. The leaks showed that the government had lied to companies, purporting to help protect them from surveillance while at the same time maintaining a backdoor into their software so it could spy at will.

Obama believed Carter could help mend this relationship. Carter had done two stints at the Pentagon earlier in his career, and at the time of his appointment

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GROOMING BY JANIS HEFFRON

was a lecturer in international studies at Stanford. The Valley is a place where brainpower is its own kind of currency, and Carter, who holds a PhD in theoretical physics from Oxford, made an impression on the locals. "For long airplane flights, he gets a pile of textbooks from the university bookstore, and he'll read for 12 hours!" says Marc Andreessen, cofounder of the venture capital firm Andreessen Horowitz. "To have someone who is that curious about the world in a position like secretary of defense is a really special thing." Andreessen and his cohort have a healthy respect for Carter, forged through their common belief that science, when properly harnessed, can help society make great leaps. Carter, for his part, nurses the quixotic belief that tech's best and brightest will, if nudged and properly inspired, tap into the same sense of public service that first compelled him to join the government.

And so on this July morning, having swapped out his slacks for blue jeans and removed his tie, he walks briskly across Sun Valley's mountainous desert resort, his aides hanging back a few feet to avoid the snapshots of the photographers. He joins Charlie Rose for a conversation before a couple of hundred startup founders, CEOs, and public intellectuals. Rose quizzes Carter on everything from the dismal efforts to train soldiers to combat the Islamic State to the legality of encryption. Carter tries to strike a balance between what the government says it needs (no encryption!) and what the tech community says it needs (encryption!). When Rose asks if the government should be allowed a backdoor into private communications, Carter replies, "I don't always think backdoors are the right answer." It's a phrase designed to elicit head nods from the audience, but he also says, "The challenge we all need to work out is how to have that freedom and protection individually while also being able to protect the public from terrorists and criminals." He may not be saying anything they haven't heard before, but they seem to be willing to give him a pass. While listening to Carter talk, one CEO emails me, "He's doing very well!!"

Wooing Silicon Valley may prove easier than the battles Carter faces on his home turf. The Pentagon is a bulging, labyrinthine, inefficient organization with misaligned resources—the military has 25 percent more real estate than it needs, for example, but not enough hackers. And while there's much to loathe in its procurement process, the basic rules exist to stop no-bid contracts and other abuses of our tax dollars. Yet somehow Carter must instill the seeds of a cultural and logistical overhaul that will make the modern military-industrial complex nimble enough to provide the kind of innovation and support its 21st-century fighting force needs.

On his first day on the job last February, he introduced an initiative he calls Force of the Future, designed to transform the personnel system so that, among other things, people can move in and out of the military more easily. He also plans to reform the procurement process just enough to make it simpler for startups to do business with the DOD. And he has established a beachhead on the West Coast, just 4 miles from Google in Mountain View, California, that will scout for companies, people, and ideas that can help the Pentagon. He calls it the Defense Innovation Unit Experimental.

Carter wants more mixing: Place career officers in agile private companies for a few months. And invite techies to spend time at the DOD.

"I'm a man in a hurry," he says shortly into our first interview. He says this a lot, and it needs to be true. He has just a year to jump-start this change before a new administration will likely bring in a new SecDef. He can't fix the military in that time, but he can change it. He can imprint upon it a new, more flexible way to work that will help it fix itself. The stakes are high because the global ecosystem we live in is precarious. And security is like oxygen. When you have it, you don't notice it. But when it is gone, you do not survive long.

Only

a couple of months after taking office, Carter returned to Silicon Valley to deliver a speech at Stanford, the first time in two decades that a secretary of defense had made the pilgrimage. After the talk, his five-car motorcade rolled up in front of the Andreessen Horowitz office. Andreessen was on paternity leave; cofounder Ben Horowitz hosted Carter for a roundtable conversation with entrepreneurs from a dozen companies. The mood was relaxed, and the entrepreneurs spoke freely. "One guy said, 'We'd love to work with the government, but some of our engineers live a certain lifestyle where they wouldn't get clearance,'" Horowitz remembers. "He was talking about weed."

Carter waved off the culture clash. When it comes to security clearances, he explained, the government tries to determine two things: First off, are you a spy? Second, is there something you're doing for which you could get blackmailed? "Marijuana is like blue laws these days," Horowitz says Carter told them, insinuating that it wouldn't be a problem. It's a position he defends. "We need to be realistic about the world in which we live," Carter says. "It's an example of how we need to be flexible with people."

Flexibility is at the heart of Carter's plan to reimagine the Pentagon's workforce, making it easier for tech's brightest minds to work for, partner with, and sell to the military. Back at the Pentagon is a young staffer who toiled for months from a closet-sized office, a twin air mattress stuffed in a box to the left of his desk so he could crash overnight—startup style—to pull together a 120-page blueprint for rebuilding the personnel system. It's packed with suggestions plucked from the tech industry, including adjusting compensation so that hard-to-hire categories—like, say, computer engineers—will be entitled to merit-based and incentive pay. It calls for setting up an Office of People Analytics, modeled after Google's data-driven HR outfit known as People Operations. Keep in mind that the Pentagon's record-keeping system hasn't changed much since the 1980s. Personnel data is scattered across several software programs that don't talk to one another. Carter wants to bring in private industry data crunchers to clean it all up and manage a vast new central computer system. "If you go to a Google or a Facebook or a Bank of America, they have teams of data scientists who will go through all this data and predict when this person is most likely to leave—and why we therefore have to do something extra for retention—or what capabilities this person may have that might match up for this particular job," says Brad Carson, undersecretary for personnel and readiness who is tasked by Carter to help reinvent the Pentagon's personnel system. Defense, he believes, should have the same—after all, it is the biggest employer in the US.

Mostly, Carter wants more mixing. Take career officers and place them in agile private companies for several-month stints. Expose them to new cultures and ideas they can bring back to the Pentagon. At the same time, invite techies to spend time at Defense. One of the most promising proposals is a fellowship program that Carter refers to internally as BNKR_75. (As in Bunker 1775, the year George

Washington launched the US military.) Following the model set by the US Digital Service—the White House's strike team of technology experts—Defense would invite individuals to take time out from their private-sector jobs to work on projects at the Pentagon.

Of course, a blueprint does not a building make. Many of the report's 80 suggestions will need to be approved by Congress. In total, they could cost up to $1 billion a year. It's not impossible. Congress has backed other reform efforts, like a significant change to the military retirement system. But even if Congress fails to act, Carter's ambitious attempt is aimed at instigating a cultural shift that will outlast his term. And it will bring in fresh thinking from the private sector.

For now, he can deliver up some initiatives, like BNKR_75, without congressional backing. He has already made use of the US Digital Service team. The week he moved into his office, he requested that a crew make it easier to transfer medical records from Defense to the Department of Veteran's Affairs so that retirees could have access to them. DJ Patil, who came to the White House from Silicon Valley earlier this year to serve as the nation's chief data scientist, helped manage the effort. "Carter put that team's office in his front office, which is almost unheard of," Patil says. Within two weeks they had completed their task.

Carter's

office is on the third floor of the Pentagon. It's a massive building. If you were to walk down every corridor, following the ankle-high glow-in-the-dark arrows that were put in place to denote emergency exits after a plane flew into the building on 9/11, you would clock 17 miles. But nobody, except perhaps Carter, would be allowed to do that, because most of the rooms are classified. To get to Carter, you pass through a dedicated entrance, up two flights of stairs, and down a corridor flanked by the portraits of the 23 men and women who run the military. You turn your smartphone *all the way* off and place it with the others in a wooden case at the door to a room where you will watch CNN until you are escorted down the hall to his majestic quarters.

He may invite you to join him at his table, which is the same one General Sherman used during the Civil War. But when I visit, we first peruse the photos on his wall. That's one of the dogs he sent to Afghanistan to sniff out improvised explosive devices in 2010. There he is shaking the hand of former Russian president Boris Yeltsin. He is most proud of the photo that displays 18 gigantic vehicles lined up in the sand of a Kuwait desert. They're MRAPs, mine-resistant ambush-protected vehicles. In 2007, secretary of defense Robert Gates fought to get these vehicles to troops being decimated by improvised explosive devices in Iraq and Afghanistan, at a cost of $50 billion. Casualty rates for soldiers in MRAPs were 75 percent lower. As Gates' undersecretary for acquisitions, technology, and logistics starting in 2009, Carter arranged for the all-terrain vehicle version, which could negotiate the rugged Afghan mountainside.

Carter never envisioned being a technologist or a military leader. The youngest of four kids born to a neurologist and a former schoolteacher, he grew up in a suburb of Philadelphia. He routinely underperformed on the wrestling and lacrosse teams but excelled in the classroom. At Yale, he majored in physics and medieval history.

He planned a career in academia, won a Rhodes scholarship, and pursued his doctorate in theoretical physics at Oxford. Over his career he has coauthored 11 books and more than a hundred papers, including one on "time reversal invariance," the proposition that the world could run backward according to the same laws by which it turns forward. It's a topic he still loves to discuss at great length. "So quantum electrodynamics only has positive and negative charge, right? You know that," he says when I ask him about his thesis. Sure, *uh-huh*. Everyone knows that.

In 1979, mentors who had been part of the Manhattan Project encouraged Carter to take a year off from academia to join a team of scientists at the Congressional Office of Technology Assessment. "They had it in their blood that there was a public responsibility that went with being a technologist, and that was bred into my generation," Carter says. This set Carter on a career path that would alternate between academia, as part of the Harvard faculty, and the Pentagon, until 2013, when he was said to have been passed over as the president's pick for SecDef. That's when he took the post at Stanford.

The job of secretary of defense isn't easy to keep filled these days. The guy Obama chose, Chuck Hagel, quit in late 2014, citing disagreements with his boss over how to handle the Islamic State. In theory the SecDef oversees a budget of somewhere around $600 billion, but in reality the funding is a moving target, because the federal government hasn't had a real budget in years thanks to automatic 10 percent annual spending cuts in place since 2012. And to make any significant changes, you need approval from a dysfunctional Congress. "When I was secretary, there was some semblance of a nonpartisan approach, and that has disappeared," Carter's mentor, William Perry, who was SecDef under President Clinton, tells me. "That has made the job more difficult."

With his hefty intellect and background of getting things done at the Pentagon, Carter is a strong pick, but his defining leadership skill goes underreported: He's really good at connecting with people. One morning we visit Walter Reed medical center, where in the physical therapy room an infantryman describes how, on the last day of his fifth tour of duty in Afghanistan, he stepped on an improvised explosive device. It ripped right through him, shredding his body up to his chest. During our visit, he's wearing red-and-white high-tops and blue socks pulled high over the prosthetics on which he is learning to shoot hoops again. Carter asks after his family and the quality of his care, lingering long enough to make his advance team impatient.

Carter has never fought in combat, but he has experienced the kind of loss that can make a person more empathetic. On the first day of his first nonacademic job, a secretary tracked him down in the lunchroom. "She said, 'Call your brother,'" Carter remembers. "And I said, 'Yeah, yeah. I will. I will.' And she said, 'Call your brother.'" His parents had been in a car accident. His father was driving and hit a tree. His mother died. A pause stretches between us as he considers this. "And then shortly after, my brother died," he says. "It's not like a big sad story, but it means I don't have much family memory." Indeed, Perry stood in for Carter's father at his wedding.

Two

and a half years ago, Edward Snowden leaked hundreds of thousands of documents that revealed the extent to which the NSA was intruding on our private lives in the name of security. The NSA, part of the Defense Department, is still reeling from the impact. "The leaks of classified information did very serious damage to our ability to protect ourselves," Carter says. "They damaged our relations with other countries, and they damaged our businesses."

Many in Silicon Valley say the government has only itself to blame. Tech companies were blindsided by the news that the NSA had built a backdoor into their servers, in a secret program called Prism. The information hit many of these businesses' international operations hard, and the pain is still being felt today.

But it has also become clear that for most companies, the post-Snowden fallout was not as catastrophic as predicted. Research firm Forrester has revised its original estimate for the economic impact of the leaks on overseas business to $47 billion, less than a third of its original reckoning of $180 billion. Only a quarter of the firms Forrester surveyed reported pulling back on spend-

ing with US Internet companies. Instead, most foreign customers bolstered their security measures, adding encryption to their data.

Meanwhile, most US Internet companies have struck an uneasy frenemy détente with Defense. Neither side can abandon the relationship, because each has too much at stake. Consider a company like Apple, whose CEO, Tim Cook, was among the executives to meet privately with Carter in Sun Valley. Cook has been an outspoken advocate for encryption. Speaking at a June awards dinner held by a pro-privacy group, he said, "We at Apple reject the idea that our customers should have to make trade-offs between privacy and security." As for whether Defense should have a master key to unlock data, he said, "If you put a key under the mat for the cops, a burglar can find it too." Those are fighting words, and yet Defense is an Apple customer. Since 2013 it has purchased more than 200,000 iPhones, iPads, and iPods.

If Snowden's legacy still colors the Pentagon's relationships with tech giants, it has less impact on its relationships with startups, most of which would like to figure out how to win Defense dollars. Traditionally this has been an onerous process. For one, a once-plentiful set of military contractors has consolidated over the past two decades. Half the requests for proposals put out by Defense receive only one bid, according to a 2014 study by the Center for Strategic and International Studies. It's difficult for startups to go through the lengthy process to become a supplier. "The Department of Defense is simply perceived as a bad customer, one that is heavily skewed in favor of larger, traditional players," reports Jason Tama, a US Coast Guard officer who spent the past year on a Brookings Institution fellowship, interviewing startup founders.

Even if a startup can navigate the complex channels required to become a contractor, some complain that the government still favors traditional players. Consider the rivalry between Elon Musk's SpaceX and United Launch Alliance, a joint venture put together by Boeing and Lockheed Martin to send military and spy satellites into space. It took Defense two years to complete the certification process for SpaceX; in that time, the Air Force awarded ULA a contract for 28 launches, prompting Musk to sue. SpaceX and the DOD settled in January, and the Air Force has certified SpaceX's Falcon 9 rocket to launch military and spy satellites.

Carter vows to make procurement easier. Take cloud services, which the military needs for everything from the mundane—storing all that personnel data—to the supersecret, like storing video footage coming in off a reconnaissance drone that may carry a dozen high tech cameras. Earlier this year, the government launched a more user-friendly website, and enterprise software companies like Box report the process now appears more straightforward. Carter plans to keep that momentum going by shortening the time it takes for vendors to get approval. "The key is to contract quickly—to not make these people fill out reams of paperwork," he says. He also expects his new West Coast office will work aggressively to identify potential suppliers.

His biggest Silicon Valley bet to date: a five-year, $170 million effort to build flexible hybrid electronics in San Jose.

On

the last Friday in August, just at the start of an Indian summer that will persist well into the fall, Carter returns to Mountain View to unveil his biggest Silicon Valley bet to date: a five-year, $170 million effort to build flexible hybrid electronics in San Jose. Speaking from a makeshift stage inside a wind tunnel on Moffett Airfield, Carter says the Defense Department will contribute $75 million to the public-private partnership, which will be run by an industry group, the FlexTech Alliance. It will dole out research funds to academics and startups to move their inventions from the lab to industry more quickly.

Flexible electronics join ultrathin silicon bits to stretchable materials, freeing them from the stiff circuit boards and chipsets that have always contained them. The result is computers that bend. Properly developed, they could have a significant impact for Defense as well as for the 96 companies (Apple and Lockheed Martin, among others) and 11 labs and universities that will contribute. Imagine a thin tablet computer that could wrap like a sleeve around a soldier's arm, replacing the awkward, heavy hardware now used for navigation and communication and substantially lightening a soldier's backpack, which can weigh more than 70 pounds. Or new types of robots that are lighter and less likely to break. Or strips of sensors that can better monitor the structural health of large and expensive military equipment (like the Doomsday Plane). For private industry, imagine a wearable medical device infused into a piece of clothing, or lightweight sensors that embed into the fiber of our bridges to help monitor their integrity.

Carter keeps his remarks brief so he can motor across Moffett to visit the newly launched Defense Innovation Unit Experimental. Just as he did during his April visit, he has organized a roundtable discussion. Andreessen, back from paternity leave, attends. So do the CEOs of Theranos and Liquid Robotics and the president of SpaceX, among others. This time, however, the military hosts. DIUx director George Duchak, a Darpa alum, has just finished his third week on the job.

DIUx doesn't fit naturally into the military's hierarchy. It is not meant to replace Darpa, but the two will likely work closely together. Nor will it try to replace In-Q-Tel, a nonprofit VC outfit the CIA started in 1999, though here, too, there may be room for partnership. Rather, think of it as a scouting office. Duchak and his team will visit startups, recruit engineers, provide desks for reservists to work on projects, and check in with Carter frequently.

Carter hopes that reducing bureaucracy and investing in research this way will have lasting impact beyond his term. But it's clear that much of the progress he has been able to realize is due to his particular skill set. It's about his ability to describe how flexible hybrid electronics work and his conviction that they must be built in San Jose, the relationships to tech execs he began cultivating long before he took the top post, and his faith that tech's brightest minds are also patriotic, driven by a sense of purpose and service that can, with the right approach, be unleashed. "They are inventing new technology, creating prosperity, connectivity, and freedom," Carter says of the moguls he met in Sun Valley. "They feel they too are public servants, and they'd like to have somebody in Washington they can connect to."

Whether patriotism compels them or they simply see new business opportunities in their relationship with Defense, many tech execs have his back. I ask Horowitz what he thinks will happen after Carter leaves office. "Secretaries of defense tend to go across administrations when they're really good," he says. He's referring to the only person who has ever done this, Robert Gates. "I'm really hoping that'll be the case here."

More likely, a new administration will bring in a fresh SecDef for tech to get to know all over again. Carter is racing the clock, attempting to seed a new image for Defense before time's up. And so he ducks out of the roundtable and walks briskly to his waiting motorcade, which rolls past Google engineers pedaling their beach cruisers through the Mountain View streets and heads over to the corporate offices of LinkedIn. It's late afternoon, but for Carter, the day is still young.

SOLAR, ECLIPSED



photographs by **BRYAN DERBALLA**



COAL? OR THE SUN? THE POWER SOURCE INDIA CHOOSES MAY DECIDE THE FATE OF THE ENTIRE PLANET.

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BY CHARLES C. MANN



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The Jharia coalfield (above) has been on fire for a century. Dust-coated solar panels (opposite) must be routinely washed. Previous page: scavengers picking for coal at one of the mines near Lilori Patra, in the Jharia coalfield.

A **FEW MINUTES AFTER** I meet E. V. R. Raju, a vision pops into my head. I can see him on one of those lists of the World's Most Important People released by the likes of CNN, *Forbes*, and *Time*. Besides the obvious entrants like the president and the pope, the lists always also include a few buzzy, click-generating names: Emma Watson, perhaps, or Bono. Raju is certainly not in either of those categories. He is the environmental manager of a coalfield in northeastern India.

The Jharia coalfield, where Raju works, is India's biggest and most significant, covering some 170 square miles. It has been on fire, calamitously, since 1916; entire villages have collapsed into the smoking ground. Raju's job is to put out the fire, so that his company can roughly double the mine's output in the next five years. Whether—and how—he can perform this task will have much more effect on the future of the world than anything, with all due respect, likely to be accomplished by UN-addressing actresses or aging Irish rock stars. In other words, if one were compiling a list of the World's Most Important People, Raju should be on it.

To judge by my visit, Raju is a busy guy. A line of functionaries with documents in envelopes wait outside the door of his surprisingly small office. Saying he has little time to talk, he waves aside a minion who offers to bring in tea. "The prime minister said the fires have to go out," he tells me. "He said money was no issue. He made a statement a few days back. Things have to happen fast." As I scribble notes, it occurs to me that a list of Most Important People should also include Prime Minister Narendra Modi—who just might deserve the top spot.

For two decades, Americans have been barraged with news about the ascent of Beijing—its economic power, its enormous size, its rising voice in world affairs. Much less attention has been paid to New Delhi. This will change. Already Earth's fastest-growing major economy and its biggest weapons importer, India is on track to become the world's most populous nation (probably by 2022), to have its biggest economy (possibly by 2048), and potentially to build its biggest military force (perhaps by 2040). What China was in the American imagination in the 1990s and 2000s, India will be in the next two decades—a cavalcade of superlatives, a focus of fears.

Nowhere is this truer than on climate change, tomorrow's single greatest challenge. For years, attention has focused on the role of China, the largest emitter of greenhouse gases, and the United States, one of the largest per capita emitters. In November 2014 the two nations promised substantial limits on greenhouse gas emissions for the first time; China has pledged that its carbon dioxide output would fall after 2030, while the US has vowed to cut its output by more than a quarter in about the same time frame. Indeed, China's emissions have fallen so fast in the past year that many believe it may achieve its target ahead of time—the biggest stride yet in the fight against climate change.

India's carbon output, by contrast, is growing faster than any other country's. Should that trend continue—and there is reason to think that it will—India could surpass China in 25 years to become the world's greatest emitter. Conceivably, its increasing emissions could offset all the efforts at curtailment in the rest of the world, leading to catastrophe. "India is the biggest piece of the puzzle," says John Coequyt, Sierra Club's director of federal and international climate campaigns. "Is there a way for that rapid growth to happen quickly and pull people out of poverty using a

lot more renewable energy than has ever been used before? Or will they build more of what they have—huge coal plants with almost no pollution controls?" The latter course, he says, would be "a disaster for everyone."

The inevitable conflict between India and other nations could come to a head as early as December's international climate talks in Paris. India appears to be participating only reluctantly—it was the last major nation to release an emissions plan. Although the plan projected big increases in solar and wind power, energy efficiency, and reforestation, it didn't actually promise to cap greenhouse gases. It also demanded rich nations pay for most of the cost, which it estimated to be "at least $2.5 trillion ... between now and 2030"—more than $166 billion a year for the next 15 years. Within weeks, environmental groups were complaining that India was threatening to capsize the negotiations, holding the whole world hostage to its demands.

Matters look different inside India. There, officials and academics have long argued that Western nations are demanding that India industrialize without burning even a fraction of the fossil fuels that developed nations consumed when they industrialized. And Indians resent that Western nations insist on the right to judge Indian performance while refusing to help with the cost of transition. "The West—not India—filled up the air with carbon dioxide," says Sunita Narain, director general of the Centre for Science and Environment in New Delhi. "The West is asking *us* to pay for *its* mistakes. They are saying, 'Oh, you are a rich country now, you can cover the cost.'"

A "premature superpower," in the words of economics writer Martin Wolf, India is focused on both increasing its influence abroad and raising its living standards at home. Its per capita income is just $1,778. (The comparable figure for the US is $51,013; China's is $6,050.) Even India's wealthy are poorer than their counterparts in the West; of the nation's richest 10 percent, a third live in households with no refrigerators. Worse, some 300 million Indians—a quarter of the population—have no electricity at all. Nearly as many have only intermittent access to it. Most of these people use kerosene for lighting and cook their food on wood or dung fires. The smoke kills about 1.3 million Indians a year, according to the World Health Organization.

Providing power to these literally powerless people is "a priority in every imaginable way—human, economic, and political," says Navroz Dubash, a senior fellow at the Centre for Policy Research in New Delhi, who is a lead author of reports for the UN's Intergovernmental Panel on Climate Change. Partly in consequence, India's demand for electricity is widely expected to double by 2030. The Modi government is determined to satisfy that demand. In fact, Modi—arguably the most powerful Indian prime minister in three decades—is pursuing this goal by charging down not one but two paths, each fraught with difficulties.

The course touted most by outsiders is an aggressive program to expand solar power. In his former position as chief minister of the western state Gujarat, Modi oversaw the construction of Asia's biggest solar park, a giant utility with battalions of solar panels. Soon after being elected prime minister in 2014, he announced that India would produce 100 gigawatts of solar power by 2022 (the US now

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"IN 2010, INDIA ANNOUNCED SEVEN SOLAR-ENERGY STORAGE PROJECTS. ONLY ONE HAS BEEN BUILT."



has about 20 gigawatts). Earlier this year, India unveiled plans to build the world's biggest solar park, in the northern state of Madhya Pradesh. This path is next to impossible: No nation has ever expanded its renewable-energy infrastructure at the speed Modi envisions. India could easily spend huge sums and still fall short of its ambitions, leaving tens of millions of people in the dark.

Simultaneously, Modi is forging a second, contradictory path: to power the nation using India's vast coal reserves, among the top five in the world. Increasing output will require transforming the corrupt, hidebound state enterprise Coal India and moving as many as a million people out of the way to extract the coal. To generate electricity from it, India plans to build 455 new coal-fired electric power plants, more than any other nation—indeed, more than the US now has. (India's existing 148 plants, which provide two-thirds of its electricity, are among the world's dirtiest and most inefficient.) This strategy has a brutal downside: vastly increased carbon emissions that would make it nearly impossible to prevent global temperatures from rising more than 3.6 degrees Fahrenheit, the goal of the Paris talks. Higher temperatures will have catastrophic implications around the globe—and India, with its long coastline, scarce water supplies, and hot climate, may be more vulnerable to the effects of climate change than any other big nation.

Last summer I spent three weeks in India, speaking to academics, activists, businesspeople, and politicians concerned with the nation's energy and climate issues. Not one person believed that India had the financial muscle to pursue both paths. One will have to be downsized, or even abandoned. In practical terms, the nation will end up making a choice: more coal or more renewables. That choice will affect the lives of the hundreds of millions of Indians who today live without lights, refrigerators, air conditioners, telephones, or the other necessities of modern life. But its ramifications will also ripple across the rest of the world.

"Indians used to be furious at the way decisions in the West—decisions in Washington and London they had no say in—could upend their lives," Narain says. "Now, I sometimes think, people in the West will understand what that feels like."

FROM AN AIRPLANE WINDOW, the coastal state of Gujarat seems like a monument to the ambitions of its native son, Narendra Modi. In a former badlands 100 miles from Ahmedabad, its biggest city, I could see sunlight reflecting from the Charanka solar park, Asia's biggest. Dozens of rectangular photovoltaic arrays, regular as Midwestern wheat fields, were scattered in a broad U over a mile on each side. By squinting a little I could talk myself into thinking I saw power lines spiderwebbing from the arrays, bringing hundreds of megawatts out of an otherwise barren expanse. Twenty miles from the airport was a metallic ribbon, a half mile long and over a hundred feet wide: a solar park built atop an irrigation canal. Southeast of the city was a second, a 2-mile tunnel of aluminum and polymer. As the plane approached the tarmac, solar panels stood like sentinels atop buildings everywhere—a vision of a green future, almost all of it brought into being by the preternaturally determined Modi.

The center of India's oldest civilizations, Gujarat is at once a cradle of Hindu identity and a busily cosmopolitan place, full of traders from across Asia. Modi arguably represents both traditions, the insular and the global. Like a subcontinental Bill Clinton, he is a charismatic figure with a resonant origin story, a passion for politics, and a reputation for flexible ethics. Modi was born in 1950, the son of an impoverished tea-stall owner in a remote Gujarat town. From adolescence, he worked as an operative for the Rashtriya Swayamsevak Sangh (National Volunteer Organization), a nativist outfit dedicated to the idea that India is an essentially Hindu nation, founded on Hindu beliefs and ideals. It has a network of schools, charities, and clubs run by disciplined cadres of conservatively dressed activists—and a violent aura; it has repeatedly been accused of organizing attacks on Christians, Muslims, Sikhs, and other non-Hindus.

In 1987, Modi joined the Bharatiya Janata (Indian People's) Party, a pro-Hindu, nationalist party tied to the RSS. He rose steadily and won election as chief minister in October 2001. A few months after the vote, a Gujarat train loaded with Hindu pilgrims and activists caught fire, killing dozens of passengers. Angered by rumors that the blaze had been set by Muslims, club-wielding Hindu thugs murdered a thousand or more people, most of them Muslim. Human rights groups charged that the BJP had encouraged the attacks. Modi, they said, stood by as Muslims died. An inquiry dismissed the accusation, but the riots stained his reputation; in 2005 he became the only person ever denied a US visa for "severe violations of religious freedom." (The decision was reversed in 2014.)

Alarmed by the fallout, Modi shifted gears, refashioning himself as a sharply dressed, tech-friendly progressive who lured major companies, foreign and Indian alike, to invest in Gujarat. He also became one of the world's most prominent advocates for solar power. In a "green autobiography" published in 2011, Modi promised to transform hot, dry Gujarat, with its 55 million people, into a model of sustainable development, simultaneously increasing irrigation and recharging aquifers, converting hundreds of thousands of cars and trucks from gasoline to natural gas, and turning the state capital, Gandhinagar, into a "solar city." He created Asia's first ministry of climate change and led a pioneering program to install solar panels atop irrigation canals, shielding the canals from evaporation and generating power without covering scarce farmland. "I saw more than glittering panels," said UN secretary-general Ban Ki-moon, inaugurating a canal-top project in January. "I saw the future of India and the future of our world."

Getting to that tomorrow will be difficult. During my visit to Charanka, it was about 110 degrees and windy. Dust, whipped into the air, obscured the sun and coated the solar panels. Pipes beneath the arrays carried water to wash them. Solar parks, farms for electrons, effectively had to be irrigated. Here and there the serried lines of panels wobbled, nudged out of alignment by harsh conditions and land subsidence. Energy from the sun today is responsible for about 1 percent of India's electricity; even in Gujarat, it amounts to just 5 percent. Optimistic government scenarios show its share rising to 10 percent by 2022. The state-owned Power Grid Corporation of India has proposed creating huge installations in Indian deserts to increase solar's share to 35 percent by 2050. Little I saw in Charanka reassured me about the plausibility of these goals. Not one person I contacted at the park would speak to me on the record; Gujarat Power, the state-run developer of the project, had stopped issuing triumphant press releases. (Gujarat has quietly junked its climate action plan.) Perhaps the lack of interest in accommodating foreign journalists





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A scavenger carrying coal in the Jharia coalfield. The area produces prime coking coal used in steel production.

meant nothing. But the complete silence when I asked about the other part of solar power—energy storage—seemed to speak volumes.

Solar panels generate electricity only between sunrise and sunset—from about 6:45 am to 6:45 pm during my visit. To provide electricity at night, power generated in daylight must be stored for later use. Typically storage systems employ the sun to heat a liquid (water, say, or molten salt); at night the stored hot liquid drives a steam turbine, producing electricity. In 2010, India announced seven solar-energy storage projects, one of them in Gujarat. Only one, in another state, has been built. The others were abandoned when the builders discovered that the air is so hazy their initial estimates of potential solar power were off by as much as a quarter.

Renewable-energy advocates are surely correct that these difficulties can be solved with sufficient will and money. That's why so many of them cheered Modi's election as prime minister in May 2014. Extolling Hinduism's ancient environmental beliefs, the BJP promised in its election manifesto to "put sustainability at the center of our thoughts and actions."

A month after his election, Modi pledged he would deliver electricity to all Indians by 2019. Soon after, he moved the date to 2022. But to accomplish that, Modi about-faced, increasingly emphasizing coal. That September he conspicuously skipped a UN climate summit. The same month, the man whose autobiography denounced the "carefully orchestrated campaigns" to foment skepticism on "whether or not [climate change] was actually happening" told an audience of schoolchildren, "Climate has not changed. We have changed ... God has built the system in such a way that it can balance on its own." In November that year, he announced India would double coal production by 2019. By then, he said, India would be producing a billion tons a year.

"DEVELOPMENT IN INDIA WILL INVOLVE MASSIVE AMOUNTS OF STEEL. THAT MEANS MASSIVE AMOUNTS OF COAL."



EIGHTEEN HUNDRED FEET below the surface, the ancient coal-mine elevator opens into a space lined with icons of Kali Ma, goddess of the hungry earth, the deity most important to miners. Railway tracks march into the distance, disappearing in the haze. I am standing in the Moonidih mine, one of 23 mines in the Jharia coalfield in northeast India. The air is hot and intensely humid despite heroic efforts at ventilation. Forty minutes' walk away is the mine face, black and glittery in workers' headlamps. A giant bore with a 6-foot drill crunches into the wall with shocking ease. Streams of water play on the head to prevent the coal dust from igniting. Wet black shrapnel flies everywhere. Behind the machine is a series of conveyor belts, rumbling one after another, conducting a black stream of coal rubble to a bunker almost 4 miles away.

The massive coalfield is owned by Bharat Coking Coal Ltd., a subsidiary of Coal India, one of the nation's biggest companies. Coal India owns more coal reserves than any other corporate entity in the country. Still, Jharia and BCCL occupy a special place in India's future. In addition to being Coal India's biggest colliery, Jharia is the nation's most important domestic source of prime coking coal, the hard coal that is an integral part of steel production—it both provides the necessary heat and the carbon that makes steel strong. Because any imaginable path of development involves making massive amounts of steel, ramping up production at Jharia is a top national priority. Achieving Modi's billion-ton target, company offi-

cials tell me, will require the colliery to increase its output by about 15 percent a year.

The men and women who must accomplish this huge task work in a landscaped headquarters that during my visits is full of people standing around in hallways and lobbies without obvious purpose. One morning I interview an able young engineer. Jammed into the other half of his office are a half dozen older men, one of them his supervisor, drinking tea and telling stories. The interview lasts nearly two hours. During that time the other men do not move. Phones do not ring. Email alerts do not ping. Keyboards lie untouched. The office door opens only to admit flunkies with tea on a tray. Leaving the engineer's office, I wonder if the activists who protest India's coal expansion plans would be comforted by this scene. Increasing productivity is going to be no easy task.

The difficulties are not all internal. The Jharia coalfield has been on fire for a century, consuming and ruining huge amounts of coal and continuing to imperil dozens of villages. When I visit the area one evening, toxic fumes, issuing from cracks in the earth, wreathe the buildings and the black, leafless trees. Patches of smoldering red are scattered like watching eyes across the charred landscape: Mordor without the Orcs.

When the coalfield opened in the late 1800s, people who wanted work simply moved into the area around the mine. In legal terms, they were squatters, but nobody wanted to drive away the workforce. In time the city of Dhanbad—population about 2.7 million—grew atop the eastern end of the deposit. Dhanbad is no squatters' camp; it is a bustling, relatively prosperous city, complete with grocery stores, restaurants, middle-class apartment blocks, and bird-stained statues of dead Indian notables. To increase production from Jharia, BCCL will not only have to put out the fire, buy millions of dollars' worth of new drill-and-conveyor assemblies, and stabilize the land riddled by fire, it will also have to relocate a large fraction of this city, its satellite communities, and the burned villages in the next few years.

Because India is a democracy, people can resist such government plans. The de facto leader of the local anticoal movement is a middle-class businessman named Ashok Agarwal. A member of the Dhanbad chamber of commerce, Agarwal lives in a pleasant two-story structure built by his grandfather. His machine-parts business is on the ground floor; his struggle against BCCL, which has lasted through 20 years of protests and litigation, is headquartered in his home, amid patterned rugs, cheerful paintings, and photographs of family members. Indian law requires that BCCL relocate not only the villagers already displaced by fire but all the people who will be affected by the mine's expansion, he tells me. "It's 700,000 families," he says. "More than 2 million people." I ask if the Indian government has ever constructed an entirely new city of that size overnight. "I don't think *any* government has," he says. "When they talk about doubling coal output, they don't mention this part." The part about moving an entire city? "Yes—that part."

Similar efforts must occur in many other places in India to fulfill Modi's goal. Unfortunately, about 90 percent of Indian coal is not Jharia-style coking coal but low-quality, highly polluting thermal coal. Outdoor air pollution, most of it due to coal, is already responsible for 645,000 premature deaths a year, according to a study published in *Nature*; New Delhi, ringed by coal plants, is said to have the world's most polluted air. Burning more



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A temple in the village of Nilkanta Rayan Gaddi (above), which gets electricity from a Selco minigrid system powered by solar energy; coal (opposite) moves down a conveyor belt at the Moonidih mine in Jharia.

coal will only make the situation worse. Already India has a high rate of chronic respiratory disease. "Success would be a disaster," Agarwal says to me. "I don't see how they get to a billion tons."

EVEN THE SMALLEST Indian villages I've seen have a store or two, and Luckman, in the southern Indian state of Karnataka, is no exception. At the edge of town stands a single kiosk, no bigger than an old-fashioned US city newsstand. Basic supplies fill its unpainted shelves: rice, lentils, oil, chickpeas, *beedis* (hand-rolled cigarettes made by wrapping leaves around tobacco flakes). At night it has Luckman's only electric light: a 6-watt LED lamp, powered by what looks like an old car battery. From the battery dangles a cable that leads to the kiosk roof, on which sits a battered solar panel about the size of a cafeteria tray. This is what solar power looks like in much of rural India.

When I walk over at about 8 pm, the owner is asleep with his head on the counter. Still, the store is open—the illumination allows him to keep the kiosk going after dark. Behind the clerk, a small girl crouches on the floor, doing homework in the pool of light. And behind her is an old woman, methodically rolling beedis for sale. The extended hours, the ability to do homework after chores, the chance to earn extra income—all of it comes from a single light.

Enabling even this small amount of electricity has long been a struggle. India's villages can be astonishingly remote by Western standards; a hamlet may be only 50 miles from a city but be next to impossible to reach, especially when the rainy season makes roads impassable. Stringing and maintaining transmission wires in such circumstances is a nightmare.

In network jargon, India has a last-mile problem, referring to the way that bottlenecks are often found in the link that physically reaches the customer's premises. Because of this challenge, the cost of building India's electrical grid was so high that rural farmers often couldn't afford to pay for their connection. To solve the problem—and to shore up sagging popularity among poor voters—the government launched a program in the late 1980s to provide free power to low-income tribal families. Unfortunately, over time and at great expense to utilities, the benefits of the program were mostly captured by wealthier, more politically powerful families. Today, 87 percent of Indian household electricity is subsidized, but less than a fifth of the subsidies go to the rural poor for whom they were intended, and the utilities have little incentive to spend what it would take to connect them. Even if India floods the sky with coal smoke, the 300 million Indians without power still might not get connected—the worst of all possible worlds.

Enter Harish Hande. Born in 1967 and raised in the eastern Indian state of Orissa, he won a scholarship and obtained an engineering PhD at the University of Massachusetts Lowell. His dissertation focused on rural electrification. When Hande returned to India, he went to the southern city of Bangalore, where he bought a solar home-lighting system with the last $300 from his scholarship. He sold it, installing the system himself. The transaction earned Hande enough to purchase a second system, which he sold, and then a third. He found a US partner who helped him obtain additional funding. In 1995 the two men incorporated a for-profit business, the Solar Electric Light Company—Selco. As Hande slowly built up his customer base, he kept asking villagers why they didn't already have electricity. For decades they had been waiting futilely for government agencies to fulfill promises to provide power. Why couldn't they go out and just get it themselves by installing solar panels?

According to Selco technical manager Jonathan Bassett, the single biggest problem was financial: Classically risk-averse loan officers at local banks found ways to avoid lending money for solar projects. Hande and his team came to believe that the route to India's energy future ran through the offices of low-level bank functionaries. Persuading and cajoling, experimenting and testing, they gradually installed 300,000 solar-power systems in remote villages in southern India and Gujarat, along with 45 branch offices to provide service and maintenance. As a rule of thumb, Bassett tells me, "We won't install systems without a branch that's less than two hours away."

Increasingly, Selco is expanding beyond individual installations—the kiosk in Luckman is one—to village-wide projects. The key, Bassett says, is the "local guy who runs the kiosk." Selco installs solar panels adjacent to the store. The electricity feeds a charging station inside the kiosk. Clipped into the station are small batteries, each the size of a cigar. At dusk, participating families send someone to fetch their battery. It connects to a Selco 6-watt LED light via a standard VGA port (the unusual plug both helps deter theft and makes it harder to damage the devices by amateur fiddling). In the morning, the families return their battery for charging. They pay 25 rupees a month (about 40 cents) for the service. The next step, now being tested, is village solar networks—with greater capacity and independent "minigrids" that allow participants to run fans, sewing machines, and computers.

Selco is far from alone; dozens of other solar ventures exist in the Indian countryside, though few have been as successful. Because solar energy is intermittent, many Indians see it as second class; a Greenpeace minigrid experiment in the northeastern state of Bihar last year was met by villagers chanting, "We want real electricity, not fake electricity!" But Selco-style projects have a signal advantage: They can expand rapidly. Selco's installations are increasing at a 20 percent annual clip. More important, the company is training 100 entrepreneurs a year to replicate its business model across the country. Instead of building huge solar parks or giant coal plants and trying to distribute electricity to remote villages, it is attempting to make the villages themselves the source of power. Hande envisions a bottom-up movement, with entrepreneurs training entrepreneurs. With luck and favorable government policies, it could represent a third path to the future—one quite different from anything as yet envisioned by Modi.

Whatever decisions India makes on the road to providing power for its hundreds of millions of unwired people, its choices will resonate around the world. Its popular prime minister has alternated between promoting renewable energy, as he did in Gujarat, and increasing the focus on coal. Neither is an easy path. Grid-style solar power requires building both massive new Charanka-style solar plants and massive energy-storage facilities, all on a scale that has never been seen in the world. It is a daunting prospect. Coal is cheaper, and there is little mystery about how to use it. But obtaining enough for India to prosper will require Coal India and other companies to sort through enormous logistical and humanitarian difficulties. And even if Modi managed to surmount them, he would be burdening India with a huge pollution problem—and the rest of the world with catastrophic carbon dioxide emissions. The nation cannot follow both paths equally. Modi, in his shifting allegiance, seems to be signaling a preference for coal.

Still, one can envision another course, in which bottom-up efforts like those from Selco could buy some time, giving rural Indians some of the most important benefits of electrification while allowing the nation to build up its renewable infrastructure. No serious study has yet laid out the conditions under which this could occur. But it is hard to believe this could happen without significant financial assistance from developed nations. (There is also the moral argument; as Narain said, the West did fill the atmosphere with carbon dioxide first.) India will fight hard for this in Paris. But ultimately the decision about assistance will be made by Europe and the US.

India will make a choice, but it will not be India's alone. W

"VILLAGE SOLAR NETWORKS ALLOW PEOPLE TO RUN FANS, SEWING MACHINES, AND COMPUTERS."



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1. Location of known office of Publication is One World Trade Center, New York, NY 10007.

2. Location of the Headquarters or General Business Offices of the Publisher is One World Trade Center, New York, NY 10007.

3. The names and addresses of the Publisher, Editor and Head of Operations are: Publisher, Kim Kelleher, One World Trade Center, New York, NY 10007. Editor, Scott Dadich, 520 Third Street, 3rd Floor, San Francisco, CA 94107. Head of Operations, Mark McClusky, 520 Third Street, 3rd Floor, San Francisco, CA 94107.

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STAR STUFF THAT HELPED GET THIS ISSUE OUT:

High-top Converse All Stars; Lupe Fiasco's "Superstar"; that time John Mayer walked into Foreign Cinema while I was eating dinner, like it was no big thing; Sun Ra's "Stars That Shine Darkly"; "Second star to the right and straight on till morning"; #catsinkimonos; "The nitrogen in our DNA, the calcium in our teeth, the iron in our blood, the carbon in our apple pies"; a big, brassy, star-shaped sheriff's badge; the five-star grilled fish taco at Nick's Crispy Tacos; all 36 minutes, 26 seconds of the Grateful Dead's "Dark Star" jam from October 28, 1972, at the Cleveland Public Hall; supermoons; astrobiologist Nathalie Cabrol; Charlie Cox (and Claire Danes) in *Stardust*; worldstarhiphop.com procrastination; Jupiter, Venus, and Regulus!

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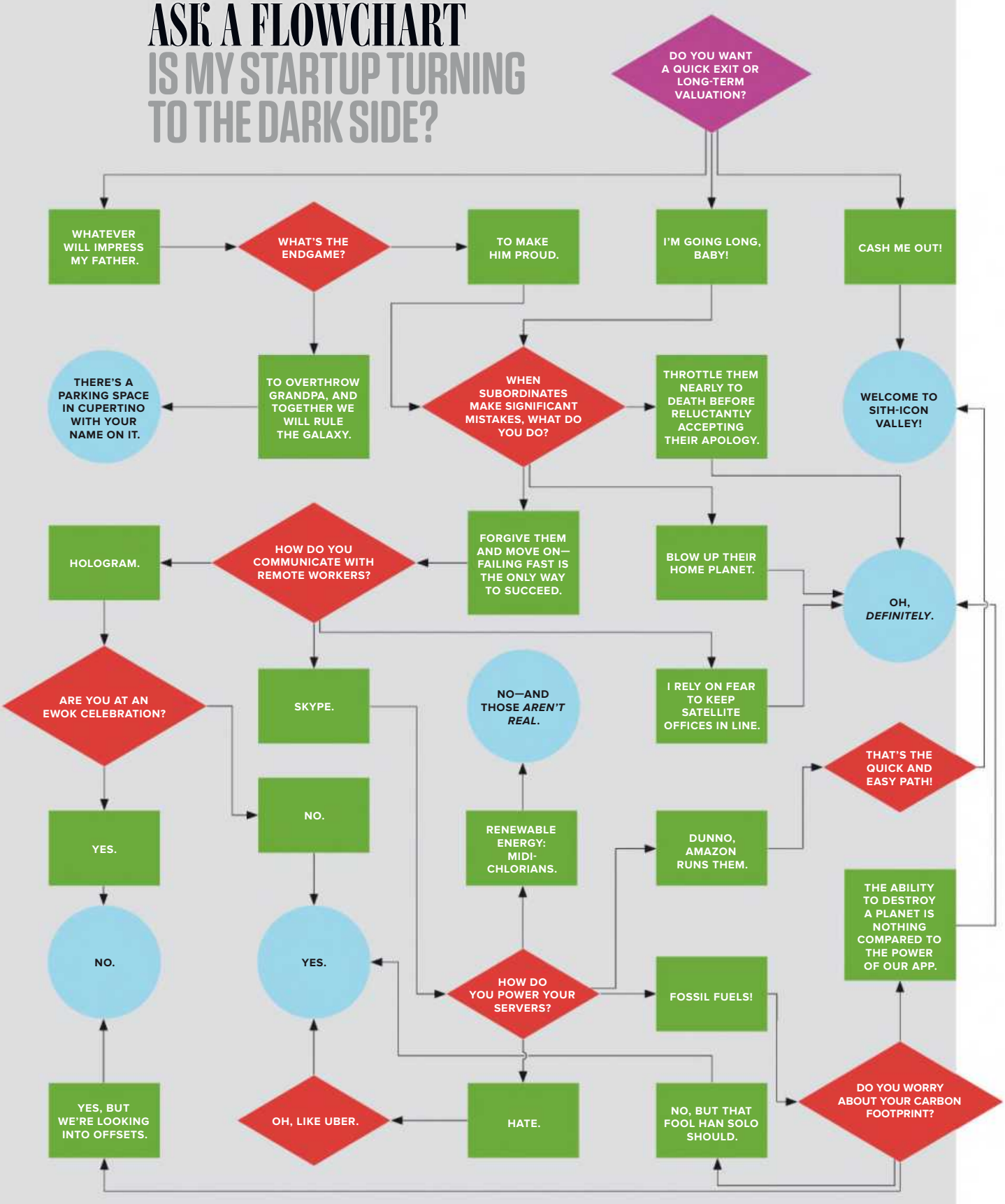
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BY ROBERT CAPPS

ASK A FLOWCHART
IS MY STARTUP TURNING TO THE DARK SIDE?



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